DOCUMENT RESUME

ED 191 734 SE 032 770

TITLE	Trying Out Some Ideas. Final Report Oregon System in Mathematics Education.
INSTITUTION	Oregon State Educational Coordinating Commission, Portland.
SPONS AGENCY	National Science Foundation, Washington, D.C.
PUB DATE	Mar 79
GRANT	NSF-SER-72-05821
NOTE	144p.
EDRS PRICE	MF01/PC06 Plus Postage.
DESCRIPTORS	Bibliographies; Computers; *Computer Science Education; Discovery Learning; Elementary Secondary Education; *Experiential Learning; Higher Education; *Inservice Teacher Education; *Mathematics Education; Mathematics Instruction; *Mathematics Teachers; *Program Descriptions; Teacher Education; Teacher Workshops; Teaching Skills; Workshops
IDENTIFIERS	Oregon System in Mathematics Education

ABSTRACT

This is the final report of the Oregon System in Mathematics Education (OSME), a project to improve mathematics education learning in Oregon. OSME in-service projects for teachers provided "hands-on" workshops for teachers at both the elementary and secondary level, and helped Oregon schools and colleges establish 24 local mathematics resource centers. The OSME program tried, in a flexible, decentralized way, to strengthen the abilities of existing institutions and instructors to meet the needs and solve the problems of mathematics education. Sections included in the report are: (1) a history and outline of the project; (2) an acronym guide; (3) sample workshop activities and teacher views; (4) projects for nurturing leadership and supplementing higher education; (5) a report on Students and Computers; (6) OSME communications activities; (7) a report on evaluation of the program; (8) listings of OSME members, staff, projects, and their leaders; and (9) a selective bibliography of documents pertaining to OSME. (MP)

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TRYING OUT SOME IDEAS

Final Report

Oregon System in Mathematics Education

March 1979

SE 032 770

Final report of the Oregon System in Mathematics Education, a project to improve mathematics education learning in Oregon, funded by National Science Foundation Grant No. SER 72-05821 to the Oregon Educational Coordinating Commission.

Any opinions, findings, conclusions or recommendations expressed herein are those of the authors and do not necessarily reflect the views of the National Science Foundation.

CONTENTS

MAKING BEGINNINGS 1
Acronym Guide

CREATING MATH ENTHUSIASTS 11
Shaking Hands: A Workshop Activity
Newberg's Math Enthusiasts
How Did Teachers Respond to Workshops?
Notes on a Summer Workshop *by Judy Johnson*

NURTURING LEADERSHIP 29
Peer-Teaching: Helping Teachers Become Leaders
Touch-Tone Math *by John del Regato*
A Day on the Circuit *by Ron Reed*

THE HIGHER LEARNING 59
Math for the Uninvolved *by Jim Young*
Vo-Tech Math
Math Resource Centers *by Don Fineran*

LEARNING COMPUTING 77
Students and Computers *by Terry Carty*

COMMUNICATION 85

EVALUATION 89

OMEC MEMBERS AND OSME STAFF 95

OSME PROJECTS AND THEIR LEADERS 98
Elementary In-Service
Leadership
Secondary and College Curricula
Computer Science Education
Communications

BIBLIOGRAPHY 141

MAKING BEGINNINGS

In 1972, the Oregon System in Mathematics Education (OSME) was established, with funds provided by the National Science Foundation, as a five-year program with a broad mandate to improve the quality of mathematics education in Oregon. Over the next five years, until 1977, OSME helped Oregon school districts, colleges and universities, and individuals conduct scores of local projects throughout the state.

OSME elementary in-service projects provided "hands-on" workshops for teachers on ways to improve their mathematics teaching--workshops presenting a plethora of useful classroom ideas and materials in an unpressured, active-learning atmosphere. OSME secondary projects provided similar workshops for teachers of "mathematically uninvolved" junior high and high school students--workshops developing strategies to interest and motivate these

students. Still other OSME projects offered workshops and courses in the instructional uses of computers and calculators.

OSME helped Oregon schools and colleges establish 24 local mathematics resource centers, where teachers can obtain ideas and materials for the classroom. OSME "math circuit riders" were established in three counties to make regular school visits, consult with teachers, and conduct demonstration math lessons on request.

More than 6,000 Oregon educators participated in OSME workshops and conferences, according to surveys. Independent evaluations of the program have found that participants in OSME activities overwhelmingly viewed them as useful, and have made desirable changes in their mathematics teaching since participating. Many OSME projects were jointly supported by OSME and local school districts, and many have been continued with local funds since OSME's end.

OSME was a unique program. Its like never existed before, and may never again. It was never intended to be transported intact anywhere else. Yet there may be lessons for others in the OSME experience. This is OSME's final report, describing what happened and how.

OSME policies were set by the Oregon Mathematics Education Council (OMEC), an 18-member board of elementary, secondary, and college teachers, school administrators, business and professional persons. A small staff managed OSME's day-to-day operation,

working with local school personnel in developing projects, to which OMEC made sub-grants.

The director of OSME was Eugene Maier, formerly professor of mathematics at the University of Oregon. Associate directors were Donald Rasmussen, formerly mathematics specialist for the Oregon Department of Education, and David Raskin, teaching strategies specialist for the Beaverton, Oregon, School District. Associate director for computer science was David Moursund, professor of computer science at the University of Oregon. Vernon Hood, of Portland Community College, served as assistant director for Portland-area projects during the first years of the program. OSME was ably served by Charlene McLain, for whom the title of secretary does not suffice. Communications director, until his death in 1973, was Lawrence Mitchell, of Lane Community College. Communications director from 1975 on was Barry Mitzman, who edited and designed this report.

A Philosophical Aside

OSME embodied a way of thinking about mathematics and education, but that way of thinking is not easily described. The staff, members of OMEC, and others involved in the program seemed to agree in general about the problems and needs of mathematics education in Oregon. But there was plenty of disagreement within that broad consensus.

Most seemed to agree that large numbers of elementary teachers have been inadequately prepared to teach mathematics. Most agreed that the teaching of mathematics in elementary schools has been too narrowly focused on computation skills--adding, subtracting, multiplying, and dividing--to the neglect of analytic and problem-solving skills involved in dealing with mathematics-related tasks of everyday life. Most agreed that math as it is commonly taught is dull, lifeless, and largely meaningless to many students--but need not be. Most agreed, moreover, that solving math problems in Oregon would require a systematic effort of educators at every level, from the daycare center aide to the university mathematician.

Thus OSME developed a set of broad central concerns, set forth in an early program document:

--Experimenting with in-service and pre-service training programs for teachers, particularly at the elementary level;

--Identifying and training persons at all levels of education who are capable of encouraging innovations in mathematics instruction and who are in positions to lead and support others in improving their instruction;

--Developing, and making highly visible, mathematics programs whose curricula and styles of teaching are exemplary of the best in mathematics education;

--Assisting other professional organizations to provide services to mathematics education.

Perhaps surprisingly, what actually occurred in OSME was generally consistent with these aims, developed at least six years ago.

OSME also embodied a management philosophy--a set of assumptions about how one ought to treat others. The staff tended to encourage and support projects that were consonant with OSME's aims and that seemed interesting, important, and workable. The staff members tended to agree about most things, though perhaps more so at the end of the project than at the beginning. The staff and OMEC decided whether to support projects on the basis of their individual and collective experience and intuition. Usually they decided with a certain humility, aware that even unlikely sounding ideas, propounded by people with a passionate belief in them, might prove successful. The assumption was that educators, agencies, and institutions have the best interests of education at heart, no matter how badly they may sometimes misconceive them. The assumption was that most people, given the chance, would do good things, and ought to be supported. That trust tended to be well-founded.

The OSME staff traveled widely and almost constantly throughout Oregon during the program's early years. They would meet with school administrators and groups of local teachers, soliciting their interest and encouraging them to develop projects. The staff's visits made formal proposals unnecessary. Teachers who would never have written a detailed proposal were thus able to participate in OSME. They simply thought through with the staff what it was they wanted to do. And the staff, involved from the beginning and confident of the result, would make needed resources available--flexibly and with little delay or red tape. In OSME's later years, teachers and administrators were more likely to

suggest project ideas without prompting. But the staff continued traveling, maintaining close ties with old projects and nurturing new ones in previously untouched areas of the state.

In sum, OSME as a program tried to take an overall view of mathematics education throughout the state of Oregon. The program developed from a particular but not parochial view of the problems and needs of mathematics education. The program tried, in a flexible, decentralized way, to strengthen the abilities of existing institutions to meet these needs and solve these problems. The program supported projects involving or affecting educators in virtually every community in the state. The program helped local schools and colleges develop programs that are now continuing without outside support. The program appears to have had measurable affects on the teaching--and learning--of mathematics.

Acronym Guide

For some mysterious reason, educators, especially mathematics educators, compete to see who can concoct the most graceless and forbidding acronyms--jumbles of letters that supposedly stand for something, though few can remember just what. Acronyms have been held to a minimum in this report, but a few are unavoidable, since the actual names of educational organizations often are as long and unwieldy as their acronyms are obscure. Herewith, a guide through the murky waters of alphabet soup.

OSME -- The Oregon System in Mathematics Education was the program developed under a five-year grant from the National Science Foundation. This report is the final report of OSME (pronounced oz-me). Herein, OSME is used to refer to the program, its staff, and any projects supported thereby. The Oregon System in Mathematics Education is such a lumbering, unmemorable name

that no one will admit inventing it, and almost no one has ever used it. Even members of the OSME staff usually have represented themselves as being from the Oregon Mathematics Education Council (see below). This has caused some confusion, but no real harm.

OMEC -- The Oregon Mathematics Education Council is the 18-member board formed to set policy for OSME. In common usage, though not in this report, OMEC is used to refer to OSME, the program, itself. The reason for this is not readily apparent, since OMEC (pronounced o-mek) is only marginally more memorable or easier to pronounce than OSME. Oregon Mathematics Education Council has the added liability of being easily confused with Oregon Council of Teachers of Mathematics (see below).

OCTM -- The Oregon Council of Teachers of Mathematics is a membership organization of mathematics educators in the state. An affiliate of the National Council of Teachers of Mathematics (NCTM), OCTM predated OSME and OMEC--also outlived them, for that matter. OCTM ran a series of communications projects for OSME. OCTM's magazine, The Oregon Mathematics Teacher, spawned its own acronym, TOMT.

OECC -- The Oregon Educational Coordinating Commission (formerly Council) provided a home for OSME in Oregon state government. OMEC was constituted as a subcommittee of the ECC, which was the official recipient of OSME grant funds.

OMSI -- The Oregon Museum of Science and Industry, in

Portland, acted as fiscal agent for OSME and OMEC. OMSI also maintained a communications resource center for the use of OSME and its projects.

CREATING MATH ENTHUSIASTS

In many ways, elementary in-service projects were the heart of OSME. They were the largest and most numerous of OSME projects, and involved the most teachers. The program's focus on the elementary schools reflected a central and all-important fact: most elementary teachers have little background in mathematics, many emerge from the colleges ill-prepared to teach it, and some even dislike doing so.

Nevertheless, the OSME staff was convinced that elementary teachers would not respond well to an extra dose of high-school or college mathematics. Along with a broader understanding of mathematics, teachers needed and wanted down-to-earth suggestions on how better to communicate basic arithmetical concepts, how to interest students in math and motivate them to learn, how to develop students' problem-solving skills, and how to relate

classroom arithmetic to the "real-world" mathematics of everyday life.

All this OSME sought to provide in its workshop-courses. Traveling around the state, the CSME staff met with groups of teachers, helped them identify their common mathematical needs, advised them of possible workshop topics and schedules, arranged for course credit through a local college or the Oregon Division of Continuing Education, and sought out talented instructors, most of whom were themselves elementary or secondary teachers.

Many of these instructors began as workshop participants who happened to show a special interest or enthusiasm. They were encouraged to help plan other workshops, to assist in leading a few, and finally to lead their own. This process of developing leaders--"math enthusiasts," they came to be known--is discussed in greater detail in the next section.

The program's choice of instructors reinforced an emphasis on providing teachers with concrete, specific, useful classroom ideas, in a format likely to find its way into the classroom. Virtually all workshops were held in local schools, and many projects provided for follow-up classroom visits by workshop leaders who assisted teachers in using and adapting what they had learned. That this emphasis was successful was evidenced by teachers' overwhelmingly favorable response, and, more objectively, by research showing that participating teachers subsequently spent more classroom time on mathematics, used a greater variety

of instructional materials, and enjoyed teaching math more than did other teachers. (For more about this, see the section on evaluation.)

In its latter years, OSME made increasing use of open-enrollment workshops not tied to any particular school district. These were mostly two-week summer workshops, open to any interested teacher. They did not involve the usual planning to meet local needs, but did offer learning opportunities for teachers with similar interests. Many of these teachers came from small school districts without enough teachers for a workshop of their own. Many of the workshops focused on ways of teaching mathematics in specific or special settings--such as in early childhood education, or in programs for Spanish-speaking children or children of migrant farmworkers.

Ultimately, according to surveys by Teaching Research, about 61 percent of all Oregon elementary teachers, more than 5,000 teachers in all, participated in at least two OSME-supported workshops. Since the end of OSME, the Math Learning Center, a non-profit organization formed by some mathematics educators involved in OSME, has continued organizing and offering workshops. Oregon colleges and universities have expanded their off-campus course offerings to teachers, and some have hired former OSME workshop leaders to teach mathematics courses.

Shaking Hands: A Workshop Activity

Let's say your're in a room with 24 other persons. Counting yourself, there are 25 persons in the room. If everyone in the room shook hands just once with everyone else, how many handshakes would there be?

A group of elementary teachers in Ontario, Oregon, tackled that problem during a workshop sponsored by the Oregon System in Mathematics Education. The problem was a real one drawn from their immediate environment: there actually were 25 persons in the elementary classroom where the workshop was held. The problem illustrates one sort of activity common in OSME workshops, and perhaps suggests how elementary math programs might become more successful.

Asked to guess the answer, many teachers thought the number of

handshakes would be 25^2 or 625. Working together in small groups, they began finding ways to check whether their guesses were correct. Some decided to send everyone out of the room, then add up the number of handshakes as each entered one at a time and shook hands with everyone else inside. (Since it was raining outside, they only pretended to send people out.)

They found that with one person in the room there were no handshakes, since one doesn't shake hands with oneself. With two persons in the room, some said there were two handshakes, some said just one. Eventually all agreed to count two persons shaking hands as one handshake.

As each person entered the room he or she shook hands with those who had entered before. Thus when the third person entered the room there were two additional handshakes, when the fourth entered there were three more handshakes, and when the fifth entered there were four more handshakes.

The group began to record its discoveries on a blackboard:

No. of Persons	No. of Handshakes
1	0
2	1
3	2
4	3
5	4
6	5
7	6

Pursuing Different Methods

As that group worked on, other groups pursued different methods. One group sent one person around to shake hands with every other person in the room. He shook a total of 24 hands. Then another person was sent around. Since she didn't shake hands again with the fellow who had gone around before her (the question stipulated that everyone shake hands with everyone else just once), she reported only 23 handshakes. The next person who went around shaking hands didn't shake hands with the first two, and so came up with a total of 22 handshakes.

This group also recorded its discoveries. After everyone had been sent around to shake hands with everyone else, the group had something like this: 24 + 23 + 22 + 21 + 20 + 19 + 18 + 17 + 16 + 15 + 14 + 13 + 12 + 11 + 10 + 9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1 = 300

Most were surprised. There were 300 handshakes with 25 persons in the room. That was far less than many had guessed.

Wondering about faster ways of finding the number of handshakes, some teachers continued working, a few eventually discovering the formula for finding all possible combinations of things: multiply the number of things by the next smaller number, and divide the product by two.

Independent and Exploratory Thinking

Most seemed to enjoy solving the problem. After working through this one and a few others, the teachers at the Ontario workshop took a look at the "word problem" exercises in a standard math textbook. They agreed that the "handshakes" problem was more interesting than any in the text, because it dealt with their immediate environment in a concrete way, and because it involved some independent, exploratory thinking as well as computation.

Some teachers may have realized for the first time that mathematics can be fun, that there are elements of creativity and even beauty in the math-related problems that arise in everyday life.

That is a point the Oregon System in Mathematics Education (OSME) was trying to make.

OSME's first and foremost aim was to strengthen teachers' preparation for teaching mathematics, especially at the elementary level. A large part of that effort involved working with local teachers and administrators to organize workshops much like the one in Ontario.

These "math enthusiast" workshops served to familiarize teachers with many of the emerging trends in mathematics education, such as metric measurement, electronic calculators in the

classroom, and "laboratory" approaches to instruction.

The workshop leaders, who usually were themselves classroom teachers, tried to communicate a sense that mathematics is not limited to textbook exercises and paper-and-pencil drill. Mathematics--in its purest form as well as in everyday life--is an investigative process of problem-solving.

Workshop participants worked through various interesting and enjoyable problems like the "handshakes" one, which are easily adaptable to their own classrooms. Many of the teachers may have begun to think about mathematics in new ways, to see that math needn't be a dull and difficult mental exercise, but can be a fascinating and fun way of exploring the world.

Newberg's Math Enthusiasts

One of the liveliest OSME activities was the Elementary Remedial Math Project at Newberg School District 24J, directed by the district's elementary math coordinator, Dorothy Rogers.

With the help of a handful of area "math enthusiasts," Dorothy ran a tutoring program bringing Newberg High School and George Fox College students into elementary classrooms to help young children with math. Dorothy herself worked regularly in "low-track" classrooms and conducted demonstration lessons at teachers' request.

Dorothy conducted local in-service workshops for Newberg teachers and conducted workshops in other districts as well. She organized several classroom math labs, a Metric Olympics, and a primary math fair which used a small-town theme to give students experiences in computation, sequencing, time, and money.

Dorothy also was responsible for maintaining the district's math resource center. And after all that, she still found time to put out a regular math newsletter informing teachers of new math materials, classes, and conferences.

Since the end of OSME, Dorothy has continued many of these activities with local funds.

MORE INFORMATION: Dorothy Rogers, Mathematics Specialist, Newberg School District, 1400 Deborah Road, Newberg, Oregon 97132.

How Did Teachers Respond to Workshops?

OSME workshop participants were asked for written comments, complaints, and suggestions both during and after workshops. Their responses were almost always overwhelmingly favorable, and they invariably said their feelings about mathematics had changed for the better.

Participants in two two-week workshops held during the summer of 1976 were given a post-workshop evaluation questionnaire. One question asked: "Has your attitude toward mathematics or to teaching math changed in any way since you began this course?" Below are the representative responses of 15 participants.

"I used to <u>dread</u> teaching math; now I can hardly wait to start implementing these ideas."

"I have a more relaxed feeling about teaching math. I think I can make math more fun for the students in my class."

"I have always liked math--now I am mentally stimulated by the new avenues available to a math teacher in helping get children 'turned on' to numbers."

"I still don't get excited about math but feel my competency to instruct is better."

"This class relieved a frustration I've had for some time. I have not, until now, had the opportunity to acquire the materials and knowledge to supplement the daily 'book routine.' ...I wish I had taken a class like this ten years ago."

"I can see how math can be made more enjoyable not only for the students but for the teacher as well."

"Math used to be my least favorite thing to teach but is becoming more of a favorite."

"I knew I was in a rut and probably felt like the kids--that it (math) was a chore that had to be done! I now feel that it can be challenging and fun to do."

"I think I will feel more comfortable in organizing my math curriculum for next year, and, therefore, be more relaxed and enjoy it more--and in turn the children will too."

"I think I shall be more confident in the use of and more willing to defend or justify the use of manipulative aides in the classroom."

"My enthusiasm is invigorated."

"I have more fully realized that my primary job is to teach how to cope with problem situations, and that this involves far more than simply teaching computational techniques."

"My attitude toward the metric system has changed. I'm not afraid to teach it now, and, with the many good ideas presented in class, I should be able to make it fun for the school children, too."

"Now I am eager to experiment with all the new ideas!"

"I can hardly wait for school to start to put a lot of these ideas to work."

Notes on a Summer Workshop

by Judy Johnson

(Judy Johnson, a teacher in the Eugene School District, led many OSME workshops. Here she shares her thoughts about a two-week series of elementary workshops she led one summer in Bend.)

In a way, my preparation for the Bend workshop took at least 15 years--15 years of classroom teaching experience. During the nine days of the workshop I shared ideas and approaches to math instruction that have worked well for me in the classroom. I tried to organize instruction to parallel the way I work with kids in the classroom.

It took me a good bit of late spring and early summer to complete preparations for the workshop (if indeed I was ever completely prepared). I prepared more activities than there would ever be time for. This allowed me to be more flexible in meeting

the needs and requests of the group once the workshop actually began, and it cut on-site daily preparation to a minimum, making for a less harried and more relaxed instructor.

Organization

Each workshop day offered variety and choice, including: a whole-group activity to get people involved right away at the start of the day, mini-sessions by grade level or interest, a problem-solving activity at the "adult level", on-going activity centers, and choice-time offerings including library area, make and take, and interest areas.

Specifically, I tried to provide activity-oriented instruction which

- contained many examples of problem-solving activities and offered opportunities for independent investigations;
- demonstrated the "manageable" use of manipulatives;
- illustrated open-ended student tasks of high interest with built-in success.

Throughout the course I tried to provide activity-oriented instruction which itself demonstrated classroom implementation strategies and organization. My message was: "Do as I do and not just as I say." The Wirtz learning matrix served as a reference framework for relating the various activities. By the end of the workshop most participants recognized that a large number of the activities they had experienced and were anxious to use in their

own classrooms began at the manipulative or representational level and were problem-solving in nature, leading often to independent investigations. They further recognized that many of the same procedures used in the workshop to acquaint participants with new materials and ideas could be used in their classrooms to implement a varied math curriculum centered on active-learning and problem-solving experiences.

Maintaining Interest

Large doses of active learning and a variety of whole-group and mini-session activities seemed to move the days along quickly and keep interest high. Interest seemed greatest when participants recognized that a given activity was applicable to their teaching situation. They appreciated the opportunity to choose sessions by interest, but didn't mind whole-group presentations as long as the activities were open-ended or applicable to a variety of levels. Some discussion of classroom implementation and adaptation of the activities to meet a variety of needs was incorporated into each of the whole-group activity sessions, as were opportunities for participants to contribute their own ideas and experiences in their own classrooms.

Problem Solving

The Wirtz learning matrix helped illuminate the role of problem

solving in elementary mathematics instruction. Practically every suggested classroom activity was examined in terms of its potential for problem-solving. Also we attempted some problem-solving at the "adult level" each day, and examined the problem-solving strategies we used in each situation. By the end of the workshop most participants not only recognized the need to involve pupils in problem-solving activities but also felt good about their own abilities to solve problems.

Implementation

I feel strongly that positive changes in teacher behavior in the classroom will result from participation in the Bend workshop. Implementation discussions were incorporated into the various activities each day, and participants were informed early in the workshop that an opportunity would be given them on the last day of the workshop to share their ideas on implementation and to ask questions of others.

In addition, participants were led to a gradual recognition that they could, in their own classrooms, use the organizational strategies used in the workshop. Most activities were written-up and distributed as handouts, with necessary patterns and directions included. These handouts also may allow workshop participants to share ideas they acquired at Bend with fellow staff members.

Though the participants showed tremendous enthusiasm and general confidence at the close of the workshop, some are sure to have questions once school starts and they attempt to implement ideas in the classroom. For this reason, I think it is important to maintain and encourage communication among participants and between participants and staff. I plan to communicate with participants several times this year.

Final Comments

I was aware throughout the workshop that participants were pleased with the course of events and were enjoying the opportunity to learn in a workshop environment. I did not, however, recognize until the completion of the workshop how successfully this workshop framework served to meet the individual needs and differences of individual participants. This became apparent to me as I read final evaluations and reread the daily comment cards. The participants were quite varied in their backgrounds and began with a variety of different expectations for the workshop. Yet each participant seemed to feel his own needs had been met, and I felt each had made substantial progress toward what I considered to be the goals of the class. An active, varied, problem-solving environment seems to meet the individual needs of both elementary students and adult learners.

I enjoyed every minute of it.

MORE INFORMATION: Judy Johnson, Consultant, Lane County Mathematics Project, 1200 Highway 99 North, Eugene, Oregon 97402.

NURTURING LEADERSHIP

OSME leadership projects might appear to have been a mish-mash of unrelated activities, but they shared one central aim: to support and extend the capabilities of other, existing agencies and institutions whose responsibilities in some way affect mathematics education.

For example, OSME sought to build a statewide network of elementary teachers identified as leaders in mathematics education--"math enthusiasts" who were willing and able to work with their fellow teachers in local schools, exploring alternative teaching methods and improving the resources available for teaching math. These "math enthusiasts" formed a benign fifth column, working within local schools and drawing on local resources to produce desired changes in mathematics curriculum and teaching. By the end of the program there were several hundred "math

enthusiasts" active in their local schools, and roughly 60 around the state on whom OSME could call to lead its elementary in-service workshops.

Beginning in 1972, OSME supported two leadership projects supporting mathematics "circuit riders" in the intermediate education districts of rural Harney and Lake counties. These two eastern Oregon counties stretch across nearly 20,000 square-miles of high desert, with an average population density of less than one person per square mile. Many of the 3,000 schoolchildren scattered over the region attend one-room schools many miles from any town of more than 2,000 people. Understandably, teachers in such small schools can feel isolated and forgotten. The math circuit riders, Ron Reed in Harney County and Dick Baxter in Lake County, make regular visits to schools on invitation, conducting demonstration lessons and consulting with teachers. The circuit riders bring a welcome link with the outside world--as well as an introduction to a variety of math teaching strategies and resources. The circuit riders were able to work with virtually all elementary teachers in the two counties, and Lake County witnessed some remarkable improvements in children's math test scores over the course of the project (see Table One).

Another leadership project sought to bridge the communication gap that traditionally separates elementary and secondary teachers. The project provided support for two high school math teachers in Glide, a small town in southern Oregon, to work with elementary teachers in the district in introducing mathematics laboratory

techniques into the elementary curriculum.

Still another project, the Lane County Mathematics Program, was a cooperative effort of OSME, the Eugene School District, and Lane Intermediate Education District. The three agencies jointly supported the work of three mathematics consultants who traveled around the county conducting "math lab" demonstration lessons in schools and helping teachers learn to use "math lab" activities on their own.

A few leadership projects helped mathematics educators gain experience helpful in their leadership roles. One project, for example, enabled a college mathematician, who was responsible for training elementary teachers but who had no elementary teaching experience himself, to spend a semester as an elementary teachers' aide, gaining first-hand understanding of the problems his own students would face.

Yet another leadership project supported efforts at the University of Oregon to develop strategies for teaching mathematics to blind children. One part of those efforts is described by John del Regato.

Insofar as OSME leadership projects sought to extend the capabilities of existing institutions, one measure of the projects' success is whether those institutions have continued the projects after OSME support ended. By that measure, at least, the Harney and Lake County circuit rider projects and the Lane County

Mathematics Program have been unqualified successes. Each has continued, entirely supported by other funds.

Peer Teaching: Helping Teachers Become Leaders

One conclusion emerges clearly from The Rand Corporation's massive study of federal programs intended to bring about change in education. It is that outside "experts" generally make poor leaders of in-service teacher education.

Rand surveyed 293 "change-agent" projects supported by the U.S. Office of Education, then undertook detailed case studies of 29 projects. Results of the study were published in Columbia University's *Teachers College Record.*

The Rand researchers found that all of the projects which used outside consultants dropped them after the first year because "they were simply not credible enough, responsive enough, or available enough to succeed."

Why not?

"Teachers . . . complained that most visiting consultants could not relate to the particular problems they were experiencing in their classrooms," one of the researchers writes. "Where outside consultants were considered useful, their participation was concrete and involved working closely with project teachers in their classrooms or in 'hands-on' workshops. However, it was unusual for outside consultants to have either the time or the inclination to provide assistance in other than a lecture format. Such expert delivery of 'truth and knowledge,' however, was seldom meaningful to participants, and foreclosed more powerful learning opportunities."

The research corroborates what most persons involved in teacher education already know: practicing teachers are interested in theory only in conjunction with useful in-service experiences directly relevant to their classroom situations. Too often traditional in-service offerings, led by college professors, professional consultants, or other entrepreneurs, fail to provide that help.

As a result, teachers have developed negative attitudes toward in-service. A recent survey by the National Council of Teachers of Mathematics found that 88 percent of classroom teachers felt a need for in-service, but 61 percent felt their previous work had not fit their classroom needs and 37 percent said it had been "a waste of time and energy."

Teachers Taking Control

There is an alternative: Teachers can begin to take on responsibility for their own professional growth. And this is beginning to happen. Teachers' associations are bringing demands for control of in-service education to the bargaining table. Teachers' centers--loosely defined as staff-controlled meeting places "where teachers share teaching experiences, have access to a wide range of instructional resources, and are trained in specific instructional competencies" --are proliferating around the country like fireflies in June. Increasingly teachers are determining for themselves what goals in-service will serve, how it will be organized, and who will conduct it.

Oregon has been part of this trend. From 1972 to 1977, teachers throughout the state collaborated in developing a statewide system of in-service training in mathematics. The Oregon System in Mathematics Education (OSME), supported by the National Science Foundation, enabled elementary and secondary teachers to lead credit math workshops for their peers from Portland to Ashland, from Astoria to Ontario. The program evolved a model of teacher in-service in which teachers themselves are the trainers--a "peer teaching" model.

OSME workshops sought to help Oregon teachers, especially elementary teachers, become more comfortable with mathematics and more enthusiastic about teaching it. The workshops offered "hands-on" experiences with a variety of useful and interesting

classroom materials, emphasizing active-learning and problem-solving activities.

A Credibility Gap

The workshops generally were led by practicing classroom teachers, many of them elementary teachers. After OSME began in 1972, the project staff quickly came around to the view that classroom teachers make the best workshop leaders. They bring a special sensitivity to other teachers' needs and feelings. They enjoy a special credibility with other teachers when they are able to say, "I tried this activity with my kids the other day and this is what happened..." Like the projects studied by the Rand Corporation, OSME found only a few college teachers able to overcome the social barriers separating them from classroom teachers.

Relying on classroom teachers to lead in-service is not easy. Many elementary teachers are "mathophobes"--they regard math as dull and difficult. They fear and dislike it. But that is all the more reason for calling on peers to lead math in-service, to show that this antipathy toward math is unfounded.

Potential leaders among classroom teachers must be identified and encouraged. OSME coined a phrase, "math enthusiasts," for those teachers who enjoy mathematics and want to help others teach it better. One of the aims of OSME was to create a cadre of "math enthusiasts" around the state to serve as in-service

leaders and as leaders generally in efforts to improve mathematics education. Five years later, OSME staff could identify 60 elementary and secondary teachers who are active "math enthusiasts."

Many more teachers were involved in OSME activities, of course, and had their attitudes toward mathematics changed as a result. A statewide field evaluation found that teachers who participated in OSME workshops changed their teaching of math, making greater use of supplementary math materials, especially manipulatives and games, than other teachers. For most teachers, OSME workshops simply were a source of ideas and materials for the classroom. For potential "math enthusiasts" the workshops may have been the beginning of a slow process of growth that leads to their leading workshops themselves.

Developing Leaders

The process of leadership development differs for every teacher involved. Individuals may enter at different points, may skip some steps, may stop at some point short of leading their own workshops. But a general model of leadership in OSME projects might look something like the following:

1. Interested teachers in a school district volunteer to form a committee to work with OSME staff in planning a series of workshops. The planning committee handles much of the publicity, obtains facilities, materials, and refreshments, and may be

encouraged to lead a few workshop instructional activities.

2. During the workshops, the workshop leader, usually a classroom teacher, identifies a few teachers who seem especially creative or interested.

3. After the workshops, interested teachers may participate in follow-up activities: some consultant help with classroom implementation or subsequent group meetings. They may be asked to help organize further workshops or other OSME activities in their school district.

4. Support may be provided for workshop participants to attend math conferences sponsored by the National Council of Teachers of Mathematics (NCTM) or its Oregon affiliate (OCTM). Some may join those organizations and begin to receive and read publications devoted to math education. On their own, they are drawn into an informal community of math-oriented teachers, and membership in this community provides support and recognition for their efforts to improve the mathematics program of their own school.

5. A few teachers may volunteer or be asked to assist an experienced workshop leader in leading a series of workshops in another school district. While assisting in a few workshops, these teachers may gradually take over more and more of the instructional activities.

6. These teachers may now be asked to conduct workshops

unassisted, in their own school or elsewhere.

7. As experienced workshop leaders, these teachers help identify other potential leaders and help train them as assistants.

Some Drawbacks

This reliance on teacher control and local teacher initiative has its drawbacks. In schools where no one is willing to lead the way in organizing a project, it is almost impossible to have one. Conversely, in schools where certain persons have established themselves as leaders, it may be difficult for other potential leaders, perhaps more talented ones, to emerge.

But overall the peer-teaching approach seems an effective way of providing in-service experiences that meet teachers' real needs. In addition, peer-teaching can help to develop cadres of active, interested, and creative teachers able to lead efforts for the improvement of mathematics education.

Touch-tone Math: Communicating with the Blind

by John del Regato

Imagine how difficult it would be to learn mathematics if you were blind. For those who can see, mathematics is largely inseparable from its visual symbolism. Psychologically, numbers and numerals are one.

Mathematics teaching in schools relies overwhelmingly on visual instruction--on printed texts and workbooks, chalkboard demonstrations, paper-and-pencil exercises. "New math" curricula have largely eliminated the sing-song chanting of arithmetic facts once common in elementary classrooms. Most math teachers feel ill-prepared to help students who have severe loss of vision.

Of course, the mathematical needs of the blind have not been ignored. The braille system enables many to "read" and "write" mathematics. Specially designed learning aids emphasizing the

tactile (touch) and kinesthetic (movement) senses have been developed. But still the blind as a group lag behind sighted persons in mathematical achievement.

One problem is that many blind persons have multiple handicaps. Some with motor coordination problems cannot distinguish the braille symbols. And compared to the visual sense, the tactile and kinesthetic senses apparently can process only a limited quantity and range of symbols. Mathematics may be humanity's highest and most important symbolic achievement. But because mathematics in its purest form is a highly abstract symbol system, it poses special learning problems.

Mathophobes and Symbol Shock

These problems are not limited to the blind. Informal discussions with sighted, self-proclaimed "mathophobes" suggest that "symbol shock"--anxiety and stress caused by extensive use of sophisticated symbol systems--is a major barrier to learning mathematics for sighted persons as well. "Symbol shock" may occur, for example, in a mathematics classroom where students are exposed to ideograms (visual symbols for concepts) with little or no exposure to phonograms (visual symbols for speech sounds). Most of us at some time have grown dizzy and confused while wading through a math text containing pages of formulas uninterrupted by a word of explanation. In those moments we taste the frustration blind persons often feel with mathematics.

Thus the problems blind people face in handling the symbolic communication of mathematics have implications for mathematics education in general. I've been concerned with these problems and spent more than a year developing and testing an auditory symbol system to help blind children learn mathematics. My studies have sought to determine whether blind children can learn to associate tonal sounds with basic arithmetic concepts and thereby increase their knowledge of basic arithmetic.

The results suggest that visually handicapped children can learn to use tones for mathematical symbols faster and easier than they can learn tactile or other available symbol systems, such as braille. This is especially true of children with motor coordination problems. The research suggests that an auditory or tonal approach to mathematics can improve the mathematical knowledge of visually handicapped students and should enable them eventually to pursue advanced mathematical topics.

Echoic Codes vs. Synthesized Speech

This tonal approach differs from that used in talking calculators, which emit the speech sounds "zero," "one," "two," and so on. The tonal approach requires the learner to associate tonal symbols (analogous to our visual symbols) with the speech sounds for numbers. This mental "symbolization" process is a key to performing arithmetic; imagine trying to do mathematics using only English words and phrases for numbers and operations. Once the

tonal symbols have been learned, computation facts can be memorized, at first at a rote associate level, by means of "echoic codes"--by humming remembered tonal patterns. These codes may enable blind children to "see" the patterns in mathematical concepts and thereby to retain specific information. The synthesized speech of talking calculators does not promote this process.

The feasibility of a tonal approach to mathematics was tested during fall 1975 at the Washington State School for the Blind in Vancouver, Wash. The study was supported by the Oregon System in Mathematics Education through a grant from the National Science Foundation.

WSSB is a residential school for visually handicapped children under age 21. The school is operated by the state of Washington. Student tuition, room, and board are free. Some 115 students are enrolled in the school. More than 80 percent are blind and have some other handicap.

Dr. Roy Brothers, superintendent of WSSB, and Dr. Ken Finlayson, principal, provided generous assistance in conducting the study. Brothers, Finlayson, and five teachers helped select the 12 students who were involved in the study. Students were selected who had normal hearing and who could understand oral instructions, but who lacked number concepts and were unable to add whole numbers.

The study was intended to explore the effects of specialized acoustical instruction, using an appropriate sensory aid, on the

mathematical learning of young blind students. A telephone touch-tone pad provided by Pacific Northwest Bell was used to construct a tonal coding system for the ten digits, addition, and equality. The touch-tone pad was supplemented by tonal bars and piano keys when necessary. Foam rubber cubes, Numberaids, pegboards, and other tactile aids were used with some students as ordinal indicators of tonal numerals and to record correct responses.

The study was conducted in a music practice room at the school. I met with each of the 12 students individually for 20 to 30 minutes 2 to 4 times a week for 9 weeks, on a schedule worked out with their teachers. Each student first took a diagnostic achievement test of my own design. Early sessions were devoted to helping students learn the tonal numerals for the numbers 0 through 9 using the touch-tone pad. Later, those who were able learned the tonal numerals for higher numbers (two-tone combinations for the numbers 10 through 99) and learned some basic addition facts using tonal symbols for numbers, addition, and equality.

If after three sessions a student had not mastered the tonal numerals one through seven, instruction with the touch-tone pad was augmented with tone-bars and piano keys. Only one of the twelve students mastered the tonal system with the touch-tone pad alone.

The following are representative case studies of six of the twelve students who participated in the study.

Dan

At the time of the study, Dan was 11 years old and totally blind from a hereditary disease. His intellectual functioning was far below the norm for a boy of his age, according to a prior psychological evaluation. The school's psychologist said Dan could not retain what he learned for any length of time. An audiologist's report showed that Dan had mild hearing loss in his right ear.

I found in my own assessment before we began tonal instruction that Dan could count from 1 to 10 and knew some of the addition facts for 1. But he lacked any other addition skills and was unable to read braille numerals.

In our first three sessions together Dan could not identify all of the first seven tonal numerals using only the touch-tone pad. But with help from tone-bars and piano keys, he was soon able to identify the tonal numerals for 0 through 99 and had mastered the addition facts for 0, 1, and 2. His retention of tonal information was excellent. Like many students in the study, Dan was soon humming tonal patterns, making effective use of echoic codes in trying to recall addition facts.

Larry

Larry, 8, was totally blind. He had limited language skills,

but was able to understand most spoken directions. He did not interact well with other children. He often preferred being alone.

Larry lacked pre-number skills and knew no addition whatsoever. He could not identify braille numerals. But he enjoyed tonal arithmetic. He was extremely attentive during our sessions and was the only student in the study who mastered the tonal numerals 0 through 7 with only the touch-tone pad. After 10 weeks, he could identify 10 tonal digits and could add 0 and 1.

Larry's addition was at a rote associative level, but his humming of tonal patterns showed he was able to retain specific arithmetic facts. Trying to remember sums, he would often cup his ears with his hands as if trying to hear something. Shortly before the tonal arithmetic sessions ended, he had mastered the tonal digits 0 through 99.

Linda

Linda was totally blind in the right eye and had only very slight peripheral vision in the left eye. At age 8 she had already undergone 16 major operations for various physical anomalies. She was pleasant and cooperative. Her pre-test showed an inability to discriminate physical characteristics of materials. Hence she lacked classification abilities. She did not understand the concepts of greater-than and less-than. She was able to count

up to 20 physical objects, but her knowledge of basic addition facts was incomplete. She could not identify the braille numerals 0, 4, 6, and 8.

With tonal instruction, Linda was able to identify the tonal numerals 0 through 29 and was able to master addition of 0 and 1.

Theresa

Theresa was a totally blind 4-year-old of about average intelligence. She could identify shapes of objects and could count to 10. But she lacked other pre-number skills and could not add.

After tonal instruction Theresa could identify the 10 tonal digits and demonstrated ability to use them in learning basic addition for 0 and 1. Though she displayed perfect accuracy in identifying tonal digits, she could not identify braille symbols for digits.

Thomas

Thomas, 6, was totally blind. He functioned at a first grade level, showing a good understanding of pre-number concepts. His understanding of basic addition facts was incomplete, and he had not mastered the braille numerals.

Thomas advanced rapidly during the tonal arithmetic sessions. He learned to add 1-digit numerals and progressed to adding 2-digit numerals. He demonstrated his understanding of addition in physical terms using tactile aids. He occasionally hummed while contemplating addition problems, showing an ability to compute addition problems rapidly when he relied on echoic codes.

Ken

Ken was the oldest student in the study, an 18-year-old who was totally blind and subject to seizures. His behavior was that of a 5-year-old, and his academic level ranged from pre-school to third grade in various skills. Yet he was a superb piano player. He had received several awards for his outstanding musical performance.

Ken could not read, write, or spell. He could count to ten. He could not identify braille numerals. He could not add.

During our sessions together Ken quickly identified the ten tonal digits and advanced to mastery of tonal numerals up to 79. He mastered addition of 0 and 1 presented in tones. The same addition problems continued to baffle him when spoken.

Conclusions and Prospects

Little is known about the development of auditory abilities and their relationship to general academic development. In mathematics instruction, educators focused on instructional methods stressing visual perception, motor development, and tactile experiences. This study supplied evidence that learners can develop echoic codes to help them learn arithmetic. The evidence suggests that a carefully constructed acoustical system could be used to improve the mathematical achievement of many visually handicapped students.

MORE INFORMATION: William Lamon, Professor, Department of Curriculum and Instruction, University of Oregon, Eugene 97403.

A Day on the Circuit

by Ron Reed

February 22 may not have been a typical day on the circuit, but it was representative of my activities. On this day, I visited three rural schools and had discussions with five teachers. The trip covered a total of 120 miles.

The first visit was to a small school 30 miles from Burns, Oregon, with only one teacher and three students. In approaching the school I had to drive through a herd of 100 to 150 head of cattle. I noticed that one of the cowboys was riding a small shetland pony and looked like he should be in school. My suspicion was confirmed when I arrived at the school; only two of the three students enrolled were there. The other one was helping his dad, a ranch hand, drive cattle from one field to another.

The two children who were there are progressing satisfactorily

and seem to enjoy mathematics. But the young man out driving cattle has a difficult time with mathematics, and a difficult time with school in general.

The children were at recess when I arrived, so the teacher and I began discussing what might help this boy. He is a third grader and studying both multiplication and division. His memory of multiplication facts is very poor. In talking with the teacher, I found she had run into some difficulty with the chairman of the school board concerning this student. In the past this teacher had always been very friendly, but had not felt the need for help. She had expressed confidence in her own mathematical abilities. But now, because of the friction between her and the school board chairman, she wanted to know, "What is the best approach, what should I be doing with this boy?"

Making Things Realistic

We discussed what she was doing and came to the joint conclusion that one thing would be to make his mathematics a little more realistic, to find some applications in the problems he is doing. I suggested taking a newspaper ad and a shopping list and asking the student to determine the cost of items on the shopping list using the newspaper ad.

I encouraged the teacher to approach math more concretely with the boy, to make things more meaningful. The teacher seemed to

appreciate that. More than anything, she was looking for support in her discussion with the board member. I assured her that I'm not a referee for discussions between board members and individual teachers, but as a consultant I'd be happy to talk with anyone about mathematics.

After leaving this school, I drove 30 miles over dirt roads to another small school with one teacher and four students ranging from grades one through five. Again I worked with the teacher, spending most of the recess and the lunch hour discussing concepts with him. I had loaned him a Tektronix Programmable Calculator the night before when he had been in Burns attending the in-service class I'm teaching. He commutes 60 miles round-trip every Wednesday to attend the class. He has not missed a session, save one scheduled the same time as a school board meeting where contract renewals were discussed. He had shown great interest in manipulatives and is using a Cuisenaire program with his first grader. He shows a great desire to make mathematics concrete for children. I instructed him in programming the Tektronix machine to use with the children. He will have the machine for a week.

At the previous class meeting I had loaned him a book on the history of mathematics. He had read of Gauss' life and asked me to explain some of the mathematics in the book. He had never heard of modular arithmetic before, so I spent about 15 minutes outlining its meaning and possible uses and applications and offered next time to give his students a lesson using modular arithmetic, although I suspect he is well capable of doing that himself once he gets a start.

Lake County Test Scores Show Marked Improvement

Since the circuit riders began their work in 1972, Lake County students have made significant improvements in their arithmetic test scores. Students in Lake County and Lakeview school districts took the Stanford Achievement Test in October of each year. Below are their grade-equivalent scores in arithmetic computation, concepts, and applications.

Lake County

		1972-73	1973-74	1974-75	1975-76
Grade 3	Computation	2.6	2.7	2.7	3.2
	Concepts	2.7	2.8	3.5	3.3
Grade 5	Computation	4.6	4.6	4.7	5.1
	Concepts	4.7	4.9	5.1	5.2
	Application	4.8	5.0	5.1	5.2
Grade 7	Computation	5.6	6.1	6.1	7.2
	Concepts	6.8	6.9	7.0	7.3
	Application	6.1	7.2	7.3	7.4

Lakeview

		1972-73	1973-74	1974-75	1975-76
Grade 3	Computation	2.5	2.8	3.1	3.3
	Concepts	2.8	2.8	3.2	3.4
Grade 5	Computation	4.0	4.2	N.A.	5.1
	Concepts	4.0	4.3	N.A.	5.2
	Application	4.8	4.8	N.A.	5.1
Grade 7	Computation	5.3	5.4	N.A.	7.1
	Concepts	6.5	6.6	N.A.	7.6
	Application	6.8	7.0	N.A.	7.3

He had some other mathematical questions and expressed a desire for more mathematics classes instead of the methods class he is now attending. I said that since we have such a small number of people at his mathematical level, I probably could not find enough students to justify such a class. But if we could arrange for reading and conference classes, we could get him started on a self-study program that would provide him credits as well as mathematical experience. We're going to look into that.

Brown Bags on the Trail

I left this school and drove to the next one 20 miles away. As I drove I ate my lunch. Sometimes I eat at the schools if I have the time. But on the road a sack lunch is a necessity; there are no service stations or stores, let alone restaurants, within the areas I am traveling.

The third school is divided into primary and intermediate classes, with two teachers and a student teacher. When I arrived I noticed the intermediate class was being taught by the student teacher. I went first to the primary section, where the teacher was happy to interrupt what she was doing.

The eight students in grades one through three are doing quite well mathematically, or at least computationally, and seem to enjoy any kind of challenge.

I cut a Mobius strip for them and tried to get them to explore it. I guess a bit of magic is appealing to them, but even these young children began observing relationships as they traced a pencil around the strips on both sides. They noticed the twist that I had put in the paper as I taped it together, and made some alert observations.

Puzzling Board Members

I'm sure that the students will take this activity home with them and I'm sure I'll hear from some of their parents. Once before I had presented a puzzle problem to this class and later ran into a member of the school board. "Say, I've got a mathematical puzzle for you," he said, and proceeded to present to me the very same puzzle I had presented to the students. It hadn't taken long for that puzzle to get from the students clear back to the school board. And the board member was very happy that the children were engaged in this kind of activity. He felt they need more mathematically stimulating activities, as well as computation. And that was reinforcement for much of what I'm doing.

After my presentation of the Mobius strip, I left a couple of "what happens if..." questions with the students and gave the teacher a short explanation privately so that she would be able to guide the students' learning. She had not seen a Mobius strip before and enjoyed the experience as much as the students.

I then went to talk with the teacher supervising the student teacher with the intermediate class. He and his students have been building a radio, and I'm planning to build one too to see whether I can stimulate a little thought in the applications of mathematics.

Soon the student teacher came in, said she was at a convenient break in her activity, and requested that I make a presentation to her class. I presented the Mobius strip again, but this time covered more material and had the students do all of the cutting and twisting. I left some more difficult open questions with them. Again I'm sure parents will hear about this activity.

Afterward I talked further with the intermediate teacher. Though he is not planning on teaching next year, he expressed an interest in gaining some further mathematical insights through a workshop-course. I told him we're considering offering a class again in the spring.

A Bald Eagle

I left this school at about 3:15 p.m. and arrived back at the office about 4 p.m. to do some paper work.

This may not have been a typical day, but it gives an indication of the type of activities I'm involved in. I don't always get to three schools in a day because of the distances between

them. But on this trip driving time occupied only about two and one-half hours, leaving about one hour to spend with each teacher.

I might mention that as I drove to the second school, ten mule deer were feeding at the side of the road. On the way to the third school, I saw an amazing variety of geese and water fowl in the fields on their northern migration. I drove within 50 yards of a bald eagle sitting on a fence, watching me drive by--a beautiful bird to watch as you drive along. The trips to the country are rewarding both for the visits with teachers and for the chance to observe wildlife. I never stopped because that would frighten the animals. But I did drive slowly and look carefully as I drove by.

MORE INFORMATION: Ron Reed, Circuit Rider, Harney County Education Service District, P.O. Box 72, Burns, Oregon 97720

Dick Baxter, Circuit Rider, Lake County Education Service District, P.O. Box 1110, Lakeview, Oregon 97630

THE HIGHER LEARNING

Some OSME projects sought to help colleges and universities improve the mathematics components of their teacher preparation programs. Mathematics courses for prospective teachers often consist of lectures in the structure of arithmetic, which teachers later may come to regard as a waste of time. OSME projects at the University of Oregon, Portland State University, and Lane Community College aimed to make teacher preparation programs more directly pertinent to the elementary and secondary classroom, by revamping courses and curricula, and by enlarging prospective teachers' opportunities for field experience.

Other projects helped schools and colleges create mathematics resource centers, where teachers can learn about, share, and borrow for classroom use a variety of books, learning aids, and classroom materials. These centers, 24 of them in all, are used

by both elementary and secondary teachers, and by college students preparing to teach. Don Fineran, the Oregon Department of Education's mathematics education specialist, has compiled descriptions of eleven math resource centers established or aided by OSME.

Still other projects sought to help secondary teachers motivate "mathematically uninvolved" students. A majority of students in many high schools take only the minimum number of mathematics courses required for graduation, and they plod through those courses, bored and resentful. Part of the problem is that few mathematics teachers have been prepared to cope with the needs of these students. OSME sought to open discussion among math teachers of how to awaken these students--how to arouse their interest in doing mathematics.

Some 60 teachers from around the state spent the better part of the summer of 1973 working together on ideas, approaches, and classroom activities for the "mathematically uninvolved" student. During the school year, the teachers tried out their ideas in their classrooms, and met periodically to compare notes. They developed a missionary zeal for spreading the "math for the uninvolved" idea, combining a theory of instruction, a focus on certain mathematical topics, and a concern for recognizing the personal characteristics and needs of students. These teachers began leading "math for the uninvolved" workshops for other teachers, in the summer and on Saturdays during the school year, in various parts of the state. By the end of OSME, more than 300 junior-high and high-school teachers had attended such workshops.

Another 350 teachers and administrators from Oregon and Washington attended a two-day conference on "math for the uninvolved," sponsored jointly by the Oregon and Washington education departments.

Some of those involved in "math for the uninvolved" created a program, funded separately by NSF, to develop math curriculum materials appropriate for "uninvolved" students. Materials produced by the Oregon Mathematics Resource Project were published recently by Creative Publications.

Math for the Uninvolved

by Jim Young

Mathematics for the uninvolved is a philosophy--a movement--a reality in many classrooms throughout Oregon.

In classrooms, math for the uninvolved is the use of ideas and materials suited to the needs and characteristics of uninvolved students.

In in-service workshops throughout Oregon, math for the uninvolved is teachers teaching teachers--sharing realities of the classroom along with ideas and materials.

By educationally uninvolved we mean the non-academic, non-college bound student who "takes" required mathematics courses and expects to terminate his or her formal education upon graduation from high school - or sooner. Among this group we may

expect to find:

- Those who could be successful in the usual mathematics courses, but are preparing for a profession that may not require them to take high school mathematics;
- Those who have learned to dislike mathematics;
- Culturally deprived students;
- Students with low ability; and
- Those students who have been labeled alienated, isolated, disadvantaged, lazy, unmotivated, low achievers, or reluctant learners.

This group includes a large segment of the secondary school population, and the ability, motivation, and mathematical competencies of the individuals in this group range across a broad spectrum.

In-service workshops for teachers of mathematically uninvolved students focus on three important aspects:

- A theory of instruction (math lab approach for active learning, large and small group instruction, problem solving, drill and practice, variety);
- Characteristics and needs of students (self-concept, attitudes, realistic expectations, ability to express and question);
- Mathematical content strands (approximation, estimation, mental arithmetic, applications, use of calculators, visual perception).

Each session of a workshop series uses a format of active participation by all members. The sessions are conducted by teachers who in their classrooms have tested the activities

they present. At each session, mathematical resources, ideas, and materials are introduced, and if the workshop series is conducted during the school year, participants are expected to adapt and use some of the ideas with their classes between workshop sessions.

MORE INFORMATION: Ted Nelson, Associate Professor, Department of Mathematics, Portland State University, P.O. Box 751, Portland, Oregon 97207

Vo-Tech Math

Oregon Vo-Tech Mathematics, a series of individualized math problem sets drawn from 22 technical occupations, has been selling like hot soldering irons since the series was published by the Oregon Board of Education and distributed by Continuing Education Publications.

In little more than a year, some or all of the problem sets were purchased by 46 Oregon school districts, 27 Oregon high schools, and 11 Oregon colleges. Some 27 sales were made to institutions in other states and Canada.

The problem sets are available by mathematical topic and by occupation. Topic sets cover percent, graphs and tables, simple equations, integers, ratios and proportions, calculus and statistics, trigonometry, algebra, square root, volume, area,

fractions, geometry, measurement and conversion, whole numbers, logarithms, and decimals.

Occupation sets are available for electronics, diesel mechanics, forestry, auto mechanics, industrial, electrical, and hydraulic engineering, aviation mechanics, welding, real estate, agriculture, wastewater technology, construction, police-fire science, wood products, industrial mechanics, nursing, drafting, clerical, forest products, food processing, and marketing.

The series was developed by a group of Oregon community college teachers with initial development funds provided by the Oregon System in Mathematics Education.

MORE INFORMATION: Continuing Education Publications, Extension Annex, Corvallis, Oregon 97330. Phone (503) 754-2676.

Math Resource Centers

by Don Fineran

Newberg Math Center

Edwards School, Newberg, OR 97132

Contact: Dorothy Rogers, 538-8361

Location: Edwards School, Sixth & Edwards St., Newberg

Hours: To be arranged. Please phone ahead. Evenings and Saturdays possible.

Open to: Any teacher, parent, or student.

See: Teacher-made activities, manipulatives, and math labs, resource books, limited commercial math labs and task cards, file drawers of math activities (with copies available to teachers).

Borrow: Anything not in use in a classroom--in exchange for one good idea.

Purchase: Since most materials are made from donated items, the center is happy to share them. Poster board and other materials may be purchased at cost.

Make&take: Math skill games, task cards, and math labs.

Portland State University Math Lab

P. O. Box 751, Portland, OR 97207

Contact: Mildred Bennett, Marjorie Enneking, or Ted Nelson, 229-3621.

Location: 305 Neuberger Hall, 724 SW Harrison St., Portland.

Hours: 8 a.m. - 5 p.m. Monday through Friday. Also open some evening and Saturday hours. Phone ahead as hours change each term.

Open to: PSU students and any teacher, parent or student.

See: More than 1,000 resource books for background for teachers and activities for children, fifteen years of The Arithmetic Teacher and The Mathematics Teacher, twenty sets of commercial lab cards, more than 400 game ideas on 5" x 8" cards, twenty file drawers of math activities, some ditto copies and some 8½" x 11" reproducible black-on-white copies, hundreds of manipulative materials, some commercial and some teacher-made, more than 100 student-made number skill games ready to try and to copy, copies of almost all mathematics textbooks, K-12, submitted to the Oregon State Textbook Commission, and at the end of each

term, 30-50 student-made learning centers.

Borrow: Books and periodicals may be checked from Friday, 3:00 p.m. until Monday, 9:00 a.m. only. This makes them available in the math lab for all users during the week.

Purchase: The 5" x 8" game cards and the black-on-white or ditto copies on 8½" x 11" paper may be purchased at 1 cent/page, our cost. Gameboards duplicated on 9" x 12" tagboard cost 3 cents each.

Make&Take: Number skill games can be copies and materials used with reimbursement at cost.

Comment: Please call ahead to make arrangements for groups of teachers to use the math lab.

North Clackamas Math Resource Center

14213 SE Johnson Road, Milwaukie, OR 97222

Contact: Sherry Haynes, Eve Boyl, Wally Rogelstad, or Eleanor Rigdon, 653-3840.

Location: Owen Sabin Occupational Skills Center, 14211 SE Johnson Road, Milwaukie.

Hours: 11:00 a.m. - 5:00 p.m., Monday through Thursday; 10:30 a.m. - 4:30 p.m. Friday. Vacation hours (including Christmas & Spring): 9:00 a.m. - 3:00 p.m. Summer schedule variable.

Open to: North Clackamas personnel, as well as any teacher, parent, and student who wishes to use the materials

in the center for classroom activities.

See: Large collection of math lab cards and materials, resource books for teachers and students, teacher-made games in easy-to-reproduce form, and manipulatives, both commercial and teacher-made. Supplies and equipment for teachers to make materials for classroom use (including laminating and box construction). Filed math activities for teacher use, in 8½" x 11" reproducible black-on-white copies. A collection of mathematics textbooks, full time aide to assist in the use of the center, and warm and friendly atmosphere.

Borrow: North Clackamas teachers only may borrow all commercial resource materials and manipulatives. Books, pamphlets, etc. for one week only. Manipulatives for three days.

Purchase: Supplies for making manipulatives and game activities; printed copies of activities, rules, and parts for games. A price list is available from the Math Resource Center aide for out-of-district personnel.

Comment: Arrangements can be made for groups of teachers to use or visit the center outside of the listed hours.

Eastern Oregon State College

LaGrande, OR 97850

Contact: Bob Rutherford or Dwight Lippe, 963-2171, Ext. 237 or 338.

Location: Curriculum Library, EOSC, CB 203.
Hours: No scheduled hours.
See: Resource books, hands-on materials, games, filmstrip-tape programs.
Borrow: All of the materials can be checked out.
Comment: A majority of the materials are being used by college students in the elementary mathematics education block.

Oregon College of Education Math Resource Center

Monmouth, OR 97361
Contact: Dr. James Barnard, 838-1220, Ext. 457, Center Ext. 465.
Location: Arnold Arms 308 (corner of Jackson and College Sts.), Monmouth.
Hours: At present--by appointment.
Open to: College students, college faculty, and local teachers.
See: Most of the materials in the Creative Publications catalog as well as the Cuisenaire catalog; calculators; books and state-adopted textbooks.
Borrow: Everything can be borrowed for a period of 3 days with arrangements for longer periods of time possible.
Comment: Classroom size sets of many of the materials are available.

Oregon State University Mathematical Sciences Learning Center

Corvallis, OR 97331

Contact: Gary Musser or Karen Swenson, 754-4686 or 754-4946.

Location: First Floor Kidder Hall.

Hours: 8:30 - 4:30, 6:00 - 10:00 M - Th, 8:30 - 4:30 F.

Open to: Anyone.

See: A multitude of resources for K-12 teachers of mathematics.

Borrow: Everything.

University of Oregon Mathematics Resource Center

Eugene, OR 97403

Contact: Glenn Beelman, Marion Walter, or Ivan Niven, 686-4705.

Location: Fenton Hall, Room 218, University of Oregon.

Hours: 8:00 a.m. - 5:00 p.m., Monday - Friday.

Open to: All teachers and all students.

See: Several thousand books, magazines, games and manipulatives related to the teaching and learning of mathematics and applications.

Borrow: Everything in the collection is catalogued and may be borrowed.

Lane County Mathematics Project

1200 Highway 99 North, Eugene, OR 97402

Contact: Oscar Schaaf, Judy Johnson, Mary Ann Todd, or Maryann Debrick, 689-6500, Ext. 75.

Location: Lane ESD, 1200 Hwy. 99N, Eugene.

Hours: 8:00 a.m. - 5:00 p.m. Other times may be arranged. Classes offered evenings.

Open to: Educators in Oregon. Since the specialists will be in the schools part of the time, prior arrangements for a visit insure assistance.

See: Commercial and teacher-made materials are on display.

Borrow: Professional books and texts for examination are loaned for two weeks. Games are not loaned, as they are models for make-and-take sessions.

Purchase: Some materials and pamphlets (limited).

Make&Take: Paper materials and tools are provided; some materials, such as 1" tile, can be purchased to complete projects.

Harney County ESD Mathematics Center

Box 72, Burns, OR 97720

Contact: Ron Reed, Mathematics Consultant, 573-6676; if no answer, 573-2426--leave number where you can be reached.

Location: Fairview housing unit no. 12, Burns.

Hours: By appointment.

Open to: Provided for all citizens of Harney County. Available to anyone.

See: Mathematics textbooks, current periodicals, commercial math lab cards, descriptions of games and activities, commercial and teacher-made games, manipulatives (Cuisenaire rods, attribute blocks, geoboards, etc.), some science materials and books.

Borrow: Any of the above material.

Make&Take: Materials for making games and activities, available at no charge to Harney County teachers.

Southern Oregon State College Mathematics Laboratory

Ashland, OR 97520

Contact: Sheldon T. Rio or Ronald S. Steffani, 482-6141.

Location: Room 219, Central Hall, SOSC, Ashland.

Hours: Variable each term. Generally daytime hours only--others by appointment.

Open to: Students and teachers.

See: Resource books for mathematics teachers, classroom sets of manipulative materials (Cuisenaire rods, geoboards, fraction bars, chip trading, etc.), sample manipulatives, mathematical games, puzzles, current adopted text series, calculators, calculator materials, metric materials.

Borrow: Most laboratory materials and books for five days (longer periods by special arrangement only).

Make&Take: Photo copies can be made for five cents each in the campus library.

Comment: Arrangements can be made to bring classes (K-12) to use the materials of the laboratory. Also, arrangements can be made to bring groups of teachers, parents, etc. for a tour of the laboratory including demonstrations of the use of materials.

Lake County ESD

118 South E, Lakeview, OR 97630

Contact: Dick Baxter or Stan Wonderley, 947-3371.

Location: 118 South E, Lakeview.

Hours: 8:30 a.m. - 5:00 p.m.

Open to: Lake County teachers, parents or lay public who wish to use materials.

See: Manipulatives, games, and other hands-on activities, file drawers of activities and ideas, approximately 100 resource books, several sets of activity cards, math and science, prepared teaching units on measurement, calculators, energy, 100's number board, geometry, daytime astronomy, etc., (these are boxed and ready for teacher use), complete set of AAAS science materials, copies of all math and science books on state-adopted list, 25 math films and about the same amount of filmstrips, many teacher-made games and activities, unit for able and gifted 7th and 8th

graders. (Each school in Lake County has a mini-math/science materials center. As many materials as possible are stored in these centers because of a lack of space at the ESD.)

Borrow: All materials can be borrowed. Most materials are borrowed for as long as needed. Films and prepared teaching units are for a two-week limit.

Purchase: No facilities for preparing a lot of materials. We can provide single copies, or dittos, of materials at our cost. No price list. Contact ESD office manager Marie Guilstine.

Make&Take: Copying machine, ditto machine, and laminating machine. Materials made by request. Most make and take done in school buildings, at in-services, or DCE classes.

Comment: ESD space limited. Teachers in Lake County are in constant contact with ESD math-science consultant. Requests for services and material are usually handled at the individual school level.

LEARNING COMPUTING

Though computers play an increasingly important role in society and are ever more widely in use, most teachers, even teachers of advance mathematics, know little or nothing about them. Computers were invented so recently and have developed so rapidly that our educational system has been caught unaware. And with a conservatism bred by ignorance, many educators--even administrators who make daily use of computers in paying bills and planning policies --regard instruction in computer literacy and computer science as an unnecessary and somewhat threatening frill.

OSME computer projects sought to provide all Oregon teachers with basic computer literacy--general knowledge of what computers are and do, how they work, and how they affect society. In addition, OSME attempted to provide teachers interested in computing with opportunities to expand their knowledge and to work

with students in expanding theirs.

Most OSME computer projects involved some sort of in-service workshops or courses for teachers. Over the five years of the program, close to 1,000 teachers were enrolled in computer workshops at schools and colleges throughout the state. OSME provided support for groups of educators working to improve opportunities for instructional computing in schools--groups such as the Oregon Council for Computer Education.

Most projects involved only modest amounts of money, enough for one or more computer enthusiasts in a school to put together an instructional computing workshop for other teachers, or to acquire a few calculators for classroom use, or to purchase a little time for instructional computing from a district's administrative computing facilities.

One project helped the Clackamas County Intermediate Education District to hire a computer science specialist who coordinates the instructional use of computers in the county. Another project enabled a mathematics teacher at Milwaukie High School to conduct workshops on instructional computing for junior high teachers in North Clackamas School District.

Before OSME began a project there in 1976, Douglas County in rural southern Oregon had no instructional facilities in any of its schools. The Douglas County Intermediate Education District had a data processing director, Jim Presley, but his duties were

largely limited to the district's administrative computing needs. OSME support helped him expand his role, to conduct an instructional computing workshop for 16 teachers, and to acquire microcomputer kits for two county high schools. The kits were assembled by advanced electronics students, and the completed microcomputers turned over for the use of math and business classes.

At Catlin-Gabel School, a private elementary and secondary school in Portland, an OSME project helped rent a few terminals for classrooms, and helped purchase a microcomputer for students' use. Project Director Ron Tenison, a mathematics teachers, established a computer education resource center of books, slides, audio and video tapes, and workshop materials. The center's holdings have been made available to the public, circulating from Eugene to Seattle. Also with OSME help, Ron Tenison has been working with first graders, using computers to teach reading skills and mathematical concepts.

Students and Computers

by Terry Carty

A physical education teacher heard a strange sound as he passed an office at John Murray Junior High School in Pendleton. He paused and entered the office. There sat three seventh graders intently staring at a computer terminal typing away.

The teacher asked what they were doing, and was taken aback by their long, detailed, and enthusiastic response. He moved closer to read the computer's print-out. Confused, he asked questions about the numbers and tables before him. The students spouted words and phrases he had heard years before in college. The teacher admitted he didn't understand, and asked just what this computer could do. The boys all began talking at once.

"Math, social sciences, science, games!"

"Games?" he asked.

One of the boys mentioned the computer could play golf, and the teacher, an avid golfer, wanted to know more. One boy invited him to sit down before the terminal. Soon the teacher was engrossed in a simulated golf game.

"Oh no, we're late for class!" one of the boys exclaimed. The teacher gave them all tardy excuses, but first made them promise to return later and help him finish his game.

Before 1973 the computer terminal at John Murray was used only by a secretary for a few hours once a week. But an August 1973 workshop in "Computers for Classroom Use" changed that. The workshop was funded by OSME, held at Blue Mountain Community College in Pendleton, and taught by Mike Neill of Eugene and Wally Waldman of Blue Mountain. Among the participants from throughout Umatilla County were two John Murray teachers.

They learned about what computers do and how they work, learned to program in a simple computer language, BASIC, and returned to school in the fall ready to make fuller use of its computer terminal. OSME provided money for some computer time during the fall quarter, and the Pendleton School District chipped in with unlimited computer time for district students in grades seven through twelve.

The two workshop participants from John Murray gained the

school secretary's cooperation in making the terminal available to students, and won administration approval for hooking up the terminal to the Columbia Region Information System, providing access to a large library of easy-to-use programs. The two teachers taught the school's other two math teachers, the librarian, and a tutor-aide how to use the terminal. The entire staff attended an after-school workshop giving them a general familiarity with computers. And a handful of seventh graders were trained as operators, to lead their classmates and assist their teachers.

John Murray is a seventh and eighth-grade junior high of about 450 students, with a program of five-week mini-courses geared to students' interests. In fall 1973 a "Computer Club" mini-course was offered for the first time, with an enrollment limit of 25. Some 65 students signed up. The overflow was accommodated in subsequent sessions, but demand has continued to grow. One instructor cannot meet all the requests.

Graduates of the "Computer Club" receive a certificate of achievement and a teletype operators' license resembling a drivers' license. To keep their licenses, students must not misuse the machinery and must strive to be good citizens of the school. In a few cases, this incentive has changed students' classroom behavior in ways welcomed by the staff.

The terminal now is used by students all day almost every day. Teachers have expressed a desire for additional programs. Tutors have found the computer useful in their remedial work. Students

seem to have better attitudes toward school in general. There have been remarkably few problems. Computers have brought a whole new dimension to education in our school.

MORE INFORMATION: David Moursund, Professor, Department of Computer Science, University of Oregon, Eugene 97403.

COMMUNICATION

When Oregon educators involved in OSME are asked about its impact, they most often speak of communication. Most seem to agree that OSME helped create a cohesive community of mathematics educators in the state--helped bring about communication and understanding across regions and across grade levels.

"I think this was the biggest plus of the whole thing," Ron Waite, an instructor at Blue Mountain Community College, said in an interview. "Everybody from kindergarten through graduate school is on the same level and can talk on the same level. Now the whole mathematics community is involved, top to bottom, and we're all equals. There's not <u>them</u> and <u>us</u>, we all sit together as mathematics educators."

OSME tried to nurture this sense of community through a

variety of projects.

OSME helped the Oregon Council of Teachers of Mathematics enlarge its membership, hire a part-time administrative assistant, and expand its publications. Council membership doubled, topping 1,000, during the five years of OSME, and the Council's monthly journal, The Oregon Mathematics Teacher, grew into a well-written and visually exciting magazine featuring creative classroom activities in a format teachers can easily use.

OSME helped the Oregon Museum of Science and Industry maintain a communications resource center as a service to mathematics educators and organizations throughout the state. The center maintained mailing lists for OSME and continues to do so for the Oregon Council of Teachers of Mathematics. The center provides mailing services for The Oregon Mathematics Teacher and Oregon Council for Computer Education, and collects and publishes inventories of math and science courses offered in Oregon schools, the texts used, and the teachers involved. Also with OSME help, the Museum established and still maintains a mathematics learning laboratory for the use of visiting schoolchildren.

OSME communications activities included a plethora of conferences on topics of current interest: math and career education, evaluation of elementary mathematics programs, mathematics education for health science careers, competency-based teacher education, unified science and mathematics curricula, mathematical problem solving, and early childhood education, among other themes.

One of OSME's most successful conferences was first held in 1974. It brought together college mathematicians from around the state who are responsible for the preparation of teachers. For the first time, really, this group had a chance to discuss matters of common concern. The conference--known as TOTOM, for Teachers Of Teachers Of Mathematics--was sponsored jointly with the Oregon Department of Education, and was so successful that it has been held annually ever since, now self-supporting from the contributions of participants.

As OSME came to a close, the program sponsored a series of four successive conferences during summer 1977 for 100 leaders in mathematics education from throughout the nation. Forty-eight states were represented at the conferences, which focused on ways of improving the continuing mathematical education of teachers. Participants saw OSME-style in-service workshops in action, attending actual workshops being given for Portland-area teachers.

During OSME's final year, publications of the Math Learning Center helped disseminate information on the results of the program. The Math Learning Center Report, an occasional newsletter, published articles on OSME activities, distributed to as many as 3,500 persons nationwide. OSME activities were featured in magazine articles published by American Education, Instructor, Teacher, McCall's, and the New York Times, as well as the Mathematics Teacher and Arithmetic Teacher.

EVALUATION

"You folks in Oregon have spent more than three million federal tax dollars trying to help teachers teach math better. How do you know you've had any effect on all those teachers in all those workshops you've held?"

More than one slightly skeptical observer began asking that question as OSME came to a close. In five years, OSME organized hundreds of in-service math workshops for thousands of teachers throughout the state, established regional math resource centers, and supported local math "circuit-rider" consultants. Many OSME projects were successful enough that local schools have been continuing them with local funds. But is there any hard, scientific evidence to show that all this effort has had much impact?

Some evidence is available from a recent survey of nearly

5,000 elementary and secondary teachers throughout Oregon. The survey was conducted by Teaching Research, a Division of the Oregon State System of Higher Education, to evaluate the impact of OSME on teachers and their teaching practices. A 61-page report on the survey was prepared by Tom Haladyna of Teaching Research.

The survey shows that OSME has touched large numbers of teachers. About 61% of all elementary teachers and 74% of all secondary teachers report that they have participated in at least two OSME-sponsored or OSME-supported workshops.

The survey indicates that teachers who have participated in OSME tend to have slightly more teaching experience, more undergraduate and graduate training in math, and more in-service experience in math than do non-participants. Participants are more likely to be members of the Oregon Council of Teachers of Mathematics, and they tend to read math magazines more often.

Teachers who have participated in OSME workshops have found them useful. Various samples of teachers rate the usefulness of OSME workshops at from 3.1 to 3.6, where 4 is "very much" usefulness and 3 is "some" usefulness.

More importantly, the survey finds that OSME participants differ from non-participants in the way they teach math.

OSME participants "appeared to implement in their classroom teaching what they had been exposed to as a result of their OSME

in-service experience," Haladyna writes. "All indicators point to changes in the direction of innovative teaching as exemplified in math games and manipulatives."

Compared to non-participants, OSME teachers report more frequent classroom use of math games, manipulatives, and math lab materials--activities encouraged in OSME workshops.

"OSME teachers," says Haladyna, "are actually implementing math lab materials, math games, and manipulatives with greater frequency and in a wide variety of ways when contrasted with non-OSME teachers. While the effect is more prominent in the elementary school, the differences between OSME and non-OSME teachers were observed for both elementary and secondary school teachers."

The report concludes, "There is little doubt that OSME has made a significant impact on teachers in Oregon. A great many have made changes in their teaching practices which can be traced back to OSME in-service experiences."

Capla Evaluation

Further evidence is being collected.

In October 1977, the National Science Foundation contracted with Capla Associates, a New Jersey consulting firm, to conduct a study that would "provide authoritative judgment on the impact and

value of OSME as a systems approach for improving mathematics education." Over the following year, Capla Associates conducted three separate surveys in Oregon: one of about 200 OSME project leaders; another of some 450 teachers; and a third of 500 fourth-grade students. The results of these surveys are not yet available. But during the winter and spring of 1978, Capla staff members visited Oregon and interviewed members of OMEC and leaders of OSME projects to gain an understanding of how OSME functioned. In June the staff issued an "Evaluation Progress Report."

The report noted that OSME activities were "strongly tied to a developmental activity-based problem-solving approach to mathematics education," an orientation which "provided the conceptual foundation necessary for educational integrity" among the various, diverse projects.

"OSME's conceptual approach provided a common language and a common perspective for system participants, and established a strong system thrust for improving mathematics education in Oregon which was based on a unified view of how children learn," the report said.

OSME's management "stressed informality, cooperativeness, and a 'grass roots' approach," the report noted. "By traveling extensively throughout the state and discussing mathematics education with teachers, administrators, and the like, the OSME staff was able to reach many districts and teachers who normally might not have taken advantage of the Project." By encouraging local

teachers to identify and develop solutions to local needs, "OSME was able to get 'grass roots' problems directly addressed by those who had to deal with the problems." Granting procedures were "uncomplicated" and "responsive," minimizing red-tape and encouraging a fair distribution of funds, "since districts which lacked personnel with proposal-writing skills could apply for and subsequently receive funds," the report said.

The report's main criticism was of OSME's evaluation procedures. OSME projects were free from red-tape in part because project leaders were not required to document what they did, beyond the normal financial accounting of their expenditures. OSME staff were in close personal contact with project leaders and aware of their progress, but the staff seldom collected--or felt a need to collect--what social scientists would accept as "hard," quantitative measures of projects' effectiveness.

Overall, the Capla report concluded, "OSME was a Project of enormous scope. It involved large numbers of educators in Oregon, and it appeared to have had some effect on many who participated in Project activities. It was well designed and it effectively utilized existing agencies and institutions."

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OSME PROJECTS AND THEIR LEADERS

COMPONENT ONE: ELEMENTARY IN-SERVICE

Projects in this group had the following common characteristics.

1. The major intention was the improvement of the elementary mathematics program in a school, school district or education service district.

2. A central feature was a continuing education or in-service activity that normally carried college or in-district credit; the focus of the activity was upon broadening elementary teachers' concept of mathematics and the development of more varied teaching strategies.

3. Project participants were selected and activities designed to enhance the identification and development of "Math Enthusiasts" to serve as mathematics teaching resource personnel in their

schools and their areas.

4. Primary responsibility for identifying problem areas and managing projects lay within local districts; each project had a local project director.

5. Participating teachers or their representatives had opportunity to be involved in planning, conducting and evaluating projects.

Project staff were either qualified local personnel who had previous training or who received training as part of the project, or college or similarly qualified personnel from other districts, or a combination of local and outside persons. Generally, System grant funds were used for instructional staff, training of local staff if necessary, materials and supplies for participating teachers, credit fees, and to defray travel and other expenses incurred by project participants. Project activities were conducted in district facilities, or occasionally at a local college. School districts normally provided facilities, project administrative services, and instructional materials necessary for classroom implementation. District's often shared in participant support. System grant funds used in support of a project were sub-granted to a participating agency (school district, education service district, college or university) or were disbursed directly from OSME to individuals or firms providing personal services or materials for the project.

Component One

Date	Project	Participants
1972-73	Salem Enthusiast Program	45 Salem area elementary teachers; 5 Portland area teachers.
1972-77	Klamath Falls Enthusiast Program	20-30 Klamath County elementary teachers each year.
1972-74	Fullerton Grade School Project, Roseburg, OR	10 staff members from Fullerton Grade School
1972-73	Union County In-Service Program	20 LaGrande area elementary teachers.
Summer 1972, 1973, & 1974	University of Portland Summer Workshops	130 Portland area teachers.
1972-73	Metro Laboratory Center, Multnomah County ESD	80 Portland area teachers.
1973-75	Treasure Valley Mathematics Project	75 elementary teachers; 25 teachers' aides from Ontario
Summer 1973, 1973-74	Union-Wallowa Counties Enthusiast Program	30 elementary teachers from Union and Wallowa counties.

Project Description	Project Director
Summer workshop with academic year follow-up to strengthen math background and develop alternative teaching strategies.	Vern Hiebert, Oregon College of Education, Monmouth, OR 97361
In-service program to develop alternative teaching strategies and strengthen math background.	Diane Reeder and Glenda Sawyer, Klamath County School Dist., Klamath Falls, OR 97601
Summer workshop on math lab approach to teaching math and support services for implementing this approach.	Larry Sconce, Douglas County School Dist. #4, Roseburg, OR 97470
Short in-service course on math lab approach.	E. Robert Bagley, Union ESD, LaGrande, OR 97850
Strengthen subject matter background of grade 5-8 teachers, especially in logic probability and statistics.	Charles White, Univ. of Portland, Portland, OR 97203
Develop lab for in-service training; in-service course on math lab approach.	James R. Norton, Multnomah ESD, PO Box 16657, Portland, OR 97216
In-service courses in math content and teaching strategies	Carl Diekhans, Treasure Valley Community College, Ontario, OR 97914
Summer course on new trends in mathematics teaching with implementation during school year.	Robert Rutherford, Eastern Oregon State College, LaGrande, OR 97850

Date	Project	Participants
1973-75	Beaverton Math Program	180 Beaverton District teachers.
1973-75	North Clackamas Enthusiast Project	Clackamas School District elementary teachers.
1973-75	Portland State University Enthusiast Project	50 elementary teachers from Portland School Dist. Area I; 50 from Portland School Dist. Area II.
1973-76	Parkrose Math Project	All Parkrose elementary teachers and secondary school math teachers.
Summer 1973	Lincoln County Enthusiast Project	12 Lincoln County teachers.
1973-74	Polk County Enthusiast Project	23 Polk County elementary teachers.
1973-76	Jackson County Enthusiast Program	75 elementary teachers from Jackson County.
1973-74	Ukiah Math Project	All Ukiah School District teachers.
1973-74	Manzanita Elementary	11 elementary teachers.

Project Description	Project Director
Summer workshop, follow-up in-service and teacher support stressing activity-oriented math teaching and improvement of mathematical knowledge.	Lee Christiansen, Beaverton School Dist., Beaverton, OR 97005
In-service program stressing implementation of math learning centers and lab approach to math.	Wallace Rogelstad, Putnam High School, Milwaukie, OR 97222
Extensive summer program with in-service follow-up stressing improvement of math knowledge and new trends in mathematics teaching.	Mildred Bennett, Portland State Univ., Portland, OR 97207
In-service program on instruction in teaching mathematics with emphasis on lab approach and development of building specialists.	Denny Westover, Parkrose School Dist., Portland, OR 97220
Summer workshop to strengthen math background and develop alternative teaching strategies.	Vern Hiebert, Oregon College of Education, Monmouth, OR 97361
Summer workshop with in-service follow-up on math content and teaching strategies.	James Barnard, Oregon College of Education, Monmouth, OR 97361
In-service program stressing math content and activity-oriented approach to math teaching.	Ron Steffani, Southern Oregon State College, Ashland, OR 97520
In-service program to develop and implement 1-12 math curriculum.	Ron Waite, Blue Mtn. Community College, Pendleton, OR 97801
In-service visitation program for school staff.	Charles Barker,

Date	Project	Participants
1973-74	Manzanita Elementary School Project	11 elementary teachers.
1973-74	Corvallis Math Enthusiast Program	30 Corvallis elementary teachers.
1974-75	Umatilla-Morrow County Enthusiast Project	55 elementary teachers from Umatilla and Morrow Counties.
1974-76	Newberg Enthusiast Project	30 elementary teachers from Newberg School District; high school cadet teachers.
1974-76	Multnomah County Enthusiast Project	130 Multnomah County teachers, of whom approx. 40 are involved in leadership training.
1974	Clackamas County Workshops	50 Clackamas County teachers.
1975-76	Parkrose Elementary Project	All Parkrose District elementary teachers.
1975-76	DCE Open-Enrollment Courses	16 in Astoria; 22 in Salem; 14 in Portland.
1977	Early Childhood	168 Oregon kindergarten and and primary teachers.

Project Description	Project Director
In-service visitation program for school staff.	Charles Barker, Josephine Co. Unit, Grants Pass, OR 97526
In-service program stressing math content and activity-oriented approach to math teaching.	Gary Musser, Oregon State University, Corvallis, OR 97331
Summer workshop on new trends in math teaching with implementation during school year.	Robert Rutherford, Eastern Oregon State College, LaGrande, OR 97850
Course on new trends in math teaching; curriculum development and development of cadet teaching program.	Dorothy Rogers, Newberg School Dist. #29-J Newberg, OR 97132
Course on new trends in math teaching; leadership development.	Jay Greenwood, Multnomah ESD, Portland, OR 97216
Two Saturday workshops on the Math Lab approach.	
Support of District resource person to conduct staff development.	Denny Westover, School Dist. #3, Portland, OR 97220
OSME coordinated courses for elementary teachers offered through the Division of Continuing Education; open to all interested persons in area. (These courses were essentially self-supporting.)	
Workshop-conference on the young child mathematics.	

In addition to the above projects, workshop courses such as "New Trends in Math Teaching" have been offered at the sites listed below. The given number is the approximate enrollment. These courses consisted of a series of workshops coordinated by the System staff, on topics such as the math lab approach, teaching metrics, calculators in the classroom, problem solving activities, effective use of math games, art and math, beanstick math. Workshop topics vary from site to site dependent upon participants needs and interests. The participants are largely elementary teachers, although secondary teachers and administrators have also participated.

Astoria 17	Forest Grove (2) . 22	Pendleton 25
Aumsville 17	Grants Pass 43	Pilot Rock 15
Baker 20	Heppner-Lexington . 20	Reedsport 15
Bend-Redmond . . . 52	Josephine County . 22	Roseburg (1) . . . 19
Boring 15	Madras 15	Roseburg (2) . . . 18
Brookings 12	Marylhurst 25	Salem (1) 75
Burns 19	McMinnville . . . 27	Salem (2) 40
Canyon City 23	Medford 21	Stayton 30
Clatskanie 30	Milton-Freewater . 23	The Dalles 30
Condon 10	Milton-Freewater (Tum-A-Lum) . . . 15	Tillamook 36
Coos Bay 17	Newberg 15	Tum-A-Lum 13
Coquille 22	Nyssa 16	Tygh Valley . . . 22
Damascus 14	Oakridge 17	Vale 25
Forest Grove (1) . 26	Ontario 21	Winston-Dillard . 43
		Woodburn 25

COMPONENT TWO: LEADERSHIP

Grouped in this component are projects which had the following common characterists:

1. The major intended outcomes were developing modes and/or personnel for providing leadership in mathematics education to meet specific needs of an educational institution or agency.

2. Project funds went for the support of individuals who provided explicit services in leadership situations or who received training enabling them to provide such services.

3. Proposed leadership activities or leadership training activities were designed by the individuals involved, in consultation with administrators and OSME staff.

4. A substantial committment was made by institutions and districts to share in the costs of programs and to make appropriate use of persons receiving leadership training.

Component Two

Date	Project	Participants
1972-75	Glide Mathematics Project	Glide School District, Douglas County.
1972-77	Harney-Lake Counties Circuit Riders	Harney and Lake Counties.
1972-73	Portland State University Professor in Residence	2 Portland State math professors.
1973-77	Development of Math Labs for Visually Handicapped	U of O Department of Curriculum & Instruction.
1973-77	Lane County Math Project	The 16 Lane County School Districts.
1973-77	OSME Leadership Program	About 25 persons throughout the state.
1973-74	Pacific University Professor-in-Residence	1 Pacific University professor.

Project Description	Project Director
Support of two staff persons to develop and implement district-wide math program.	Leon Powell, Glide School Dist. #12, Glide, OR 97443
Provide math curriculum services and in-service assistance to all schools and teachers in Harney and Lake Counties on regular basis. (Costs are shared with counties.)	Ron Reed, Harney ESD, Burns, OR 97720 and Richard Baxter, Lake ESD, Lakeview, OR 97630.
Provide extensive public school experiences for math professors charged with training teachers.	Vernon Hood, Portland Community College, Portland, OR 97219
Development of math learning aids for the blind and training in their use.	William Lamon, U of O, Eugene, OR 97403
Provide schools in Lane County with leadership to implement math labs as schools request their services. (Over 60% of project funds come from local sources.)	Oscar Schaaf, Lane ESD, Eugene, OR 97402
Providing additional training or field experience for persons in leadership positions.	
Provide elementary school experience for mathematics education faculty.	Vern Hood, Portland Community College, Portland, OR 97219

COMPONENT THREE: SECONDARY AND COLLEGE CURRICULA

Activities in this component were aimed at making major changes in the mathematics programs offered in secondary schools, colleges, and universities. Four areas emerged as primary concerns, and these were the focus of OSME activities. These areas were secondary school general mathematics courses, pre-service training of mathematics teachers, mathematics for technical-vocational students, and pre-calculus college mathematics.

1. General mathematics at the secondary level. Such courses often have been labeled "remedial." They emphasize basic practical skills for students who have performed poorly in previous mathematics courses but are required to pass some mathematics course for graduation. The local term for such students in "the uninvolved." OSME supported programs by teachers committed to changing the philosophy and methods associated with general mathematics courses.

2. Pre-service teacher training program. OSME aimed to change the courses in mathematics and mathematics education offered pre-service elementary teachers. These courses at some colleges have tended to be lecture courses in the structure of arithmetic. Existing courses were changed, or new courses introduced, in which the mathematics content was broadened and teaching methods were appropriate for elementary teachers to use in their classrooms. A major emphasis was development of a network of related mathematics resource centers supporting pre-service training programs and providing services to practicing teachers.

3. Technical-vocational programs. Major objectives, were the identification of mathematical needs of vocational-technical students and the preparation and evaluation of problem sets and instructional packages for specific occupational programs. The project received close cooperation and financial support from the Career Education and Manpower Training Section of the Oregon State Department of Education, a number of Oregon community colleges, and several school districts now using project materials in their high school career-cluster programs.

4. Pre-calculus College Mathematics. Activities included a series of conferences for community college and four-year college teachers concerned with the pre-calculus curriculum.

Component Three

Date	Project	Participants
1972-75, 1977-78	Voc-Tech Math Curricula Project	50 community college and high school teachers.
Summer 1972	EOSC Summer Workshop	40 5th to 7th grade teachers in LaGrande area.
1972-73	Elementary Mathematics Cooperative Program	15 community college instructors from 7 different community colleges.
1972-73	Video-Tape Production	Blue Mountain C.C., Lane C.C., Portland C.C., Mt. Hood C.C.
1972-73	PSU Remedial Mathematics Training Center	30 PSU undergraduates, 10 teachers and aides, Portland public school students.
1972-77	U of O Math Resource Center	
1973-74	Lane Community College Field Experience	50 pre-service teachers; students and staff from 12 schools.
Summer 1973	Twality Junior High Lab Program	10 teachers from throughout the state.

Project Description	Project Director
Development of materials for voc-tech math courses and implementation of these into classrooms. (Has received support from variety of sources.)	Dell Swearingen, Linn-Benton Community College, Albany, OR 97321.
Workshop examining curricular materials for remediation in junior high schools.	Robert Rutherford, Eastern Oregon State College, LaGrande, OR 97850.
Development of freshman-level courses and field experiences for pre-service teachers.	Casey Fast, Lane Community College, Eugene, OR 97405.
Preparation of single concept video tapes to augment classroom instruction.	Gary Nichols, Mt. Hood Community College, Gresham, OR 97030.
Establishment of remedial training centers at PSU Educational Center and graduate school in cooperation with Portland School Dist.; training pre-service and in-service teachers and aides in remediation techniques.	Gavin Bjork, Portland State University, Portland, OR 97207
Development of resource center and curriculum for pre-service training programs and use of area teachers.	Alan Hoffer, University of Oregon, Eugene, OR 97403.
Use of pre-service teachers to conduct math fairs in area public schools.	Casey Fast, Lane Community College, Eugene, OR 97405.
Development of lab activities for junior high students.	Verne Martin, Tigard School Dist. #23J, Tigard, OR 97223

Date	Project	Participants
1973-75	PSU Program for Pre-Service Elementary Education	
1973-75	PSU Program for Secondary Teachers of General Mathematics	57 Portland area high school teachers.
1973-78	Math for the Educationally Uninvolved	250 high school teachers throughout the state.
1974-77	OSU Resource Center	
1974-77	Reed-Lewis and Clark Cooperative Program	
1974-75	Dissemination of Mathematics Resource Materials	
1974-75	Improvement of Pre-Calculus Instruction	45 community college, college and university mathematics professors.
1974-77	PSU Resource Center	
1975-76	EOSC Lab Materials	

Project Description	Project Director
Development of competency-based elementary math teaching pre-service program.	Gavin Bjork, Portland State University, Portland, OR 97207.
Development and implementation of teaching strategy in general math classes.	Marjorie Enneking, Portland State University, Portland, OR 97207
Development and implementation of teaching strategies for high school students who have had unsuccessful math learning experiences.	Ted Nelson, Portland State University, Portland, OR 97207.
Development of resource center for pre-service and in-service training programs.	Gary Musser, Oregon State University, Corvallis, OR 97331.
Subsidization of new fifth-year certification program for high school math teachers.	John Leadley, Reed College, Portland, OR 97202.
Design and trial of plans for dissemination of information and materials developed in conjunction with the Math for the Uninvolved Project.	Gary Musser, Oregon State University, Corvallis, OR 97331
A series of 3 conferences for college teachers focusing on the pre-calculus curriculum.	Howard Wilson, Oregon State University, Corvallis, OR 97331.
Providing materials for mathematics resource center used in pre-service and in-service training programs.	Mildred Bennett, Portland State Univ., Portland, OR 97207.
Organize math lab materials to be used in pre-service courses.	Robert Rutherford, Eastern Oregon State College, LaGrande, OR 97850

Date	Project	Participants
1975-77	Satellite Resource Centers	
1975-76	Wasco-Hood Counties	8 secondary teachers.
1975-76	DCE Open-Enrollment Courses	7 enrolled in Portland (3 credits); 11 enrolled in Coos Bay (3 credits).
1975-76	Salem Uninvolved Project	14 Salem area secondary teachers.
1976	Silverton Mathematics Project	15 Silverton School Dist. teachers.
1976	Corvallis Uninvolved Project	25 secondary teachers from the Corvallis area.
1976	Parkrose Secondary Project	All Parkrose junior high and high school teachers.
1977	Lake County Gifted	

Project Description	Project Director
Establishment of Mathematics Resource Centers at Oregon College of Education, Southern Oregon State College, Eastern Oregon State College, and Pacific University as secondary centers to the U of O, OSU and PSU centers.	James Barnard, Oregon College of Education; Sheldon Rio, Southern Ore. State College; Robert Rutherford, Eastern Ore. State College; Michael Clock, Pacific University.
Course for teachers of the uninvolved.	Harley Earl, The Dalles High School, The Dalles, OR 97058.
OSME coordinated course for teachers of the uninvolved student; open to all interested persons. (Tuition pays approximately 75% of costs.)	James Young, Willamette High School, Eugene, OR 97402.
Course for teachers of the uninvolved.	James Young, Willamette High School, Eugene, OR 97402.
A course on motivating the middle school student to study mathematics.	Ted Nelson, Portland State University, Portland, OR 97207.
Course for teachers of the uninvolved.	Gary Musser, Oregon State University, Corvallis, OR 97331.
A series of seminars to improve mathematics instruction at the secondary level.	OSME staff
Organize and develop mathematics materials for use with gifted secondary school students.	Richard Baxter, Lake ESD, Lakeview, OR 97630.

Date	Project	Participants
1977	Applications Clusters for Pre-Calculus Mathematics at OSU	
1977	Secondary Mathematics Alternatives	

The following are NSF Summer Institutes, AYE's and In-Service programs. These are programs that were under consideration when OSME began and nominally would have received funding from other NSF program divisions.

Date	Project	Participants
1972	Southern Oregon College Summer Program	36 Oregon secondary teachers.
1972-73	Oregon State University Summer Program	23 secondary teachers.
1972	University of Oregon Summer Program	51 secondary teachers (37 from Oregon).
1972-73	University of Oregon In-Service Program	20 secondary teachers in fall, 23 in winter, & 10 in spring term.

Project Description	Project Director
Gather applications of mathematics from professional areas to be used in pre-calculus math classes.	J. Michael Schaughnessy, Oregon State University, Corvallis, OR 97331.
Study to determine why academically able Oregon high school students do not take college-preparatory mathematics.	Howard L. Wilson, Oregon State University, Corvallis, OR 97331.

Project Description	Project Director
Summer institute program stressing geometry. Also received funding from NSF Grant GW-6834.	Robert A. McCoy, Southern Southern Oregon College, Ashland, OR 97520
Completion of sequential summer institute for high school teachers. Also received funding from NSF Grant #GW-7234.	William H. Simons, Ore. State University, Corvallis, OR 97331.
Completion of sequential summer institute for high school teachers. Also received funding from NSF Grant #GW-7235.	A. F. Moursund, Univ. of Oregon, Eugene, OR 97403.
A series of 3 classes for secondary teachers in the Eugene area.	Alan Hoffer, Univ. of Ore., Eugene, OR 97403.

Date	Project	Participants
1972-73	University of Oregon Academic Year Program	13 Oregon secondary teachers.
1972-73	Marylhurst In-Service Program	51 secondary teachers from Portland area.
1972-73	Reed In-Service Program	12 secondary teachers from Portland area.
1972-73	Portland State University Summer Program	21 secondary teachers from the Portland area.
1972	University of Oregon Computing Program	42 secondary teachers.

Project Description	Project Director
A year's intensive study for high school mathematics teachers.	Alan Hoffer, University of Ore., Eugene, OR 97403.
Two semester math classes for secondary teachers in the Portland area.	Sister M. Colbert, Marylhurst Education Cntr., Marylhurst, OR 97036.
Two semester math classes for secondary teachers in the Portland area.	John Leadley, Reed College, Portland, OR 97202.
Courses in statistics and computing for high school teachers.	Leonard Swanson, Portland State University, Portland, OR 97207.
Courses in computer science and numerical analyses for high school teachers. Also received funding from NSF Grant GW-7232.	David Moursund, University of Oregon, Eugene, 97403.

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COMPONENT FOUR: COMPUTER SCIENCE EDUCATION

System activities in this component were carried out in close cooperation with the Oregon Council for Computer Education. A major focus was improving the instructional uses of computers, through administrative awareness and/or training, in-service teacher training, information dissemination, leadership development, planning and coordination, and experimental programs.

Other computer education activities sought to develop students' "computer literacy" through existing science, social science and mathematics courses and through new computer literacy courses.

Component Four

Date	Project	Participants
Summers 1972, '73, '74, '75, '76.	University of Oregon Summer Computer Science Program	150 educators from throughout the state.
Summers 1972, '73, '74	Colorado Materials Workshop	32 teachers from Willamette Valley area.
1972-77	Oregon Council of Computer Education	
1972-76	Rogue Valley Council on Computer Education	Southern Oregon State College, Jackson ESD, Rogue Community College and 7 high schools.
Summers 1973, 1974	Washington County Computer Science Summer Program	39 elementary and secondary teachers from Washington County.
1973-76	Umatilla ESD Computer Science Project	65 Umatilla County teachers.
Summers 1973, 1974	EOSC Computer Science Project	30 LaGrande area teachers.
1974-75	Lane ESD Elementary School Project	14 elementary schools in Lane County.
1974-75	West Sylvan Elementary School, Beaverton	West Sylvan high.

Project Description	Project Director
Summer program to train leadership personnel in computer science education in all levels.	David Moursund, Univ. of Oregon, Eugene, OR 97403.
One-week workshop to acquaint teachers with computer science materials prepared in the NSF-supported Colorado Project.	William Best, 3827 Hawthorne Avenue, Eugene, OR 97402.
Support of OCCE task groups and conferences.	Howard Bailey, Eastern Oregon State College, LaGrande, OR 97850.
Establish instructional computer network in Rogue Valley; in-service program to train teachers of computer science.	Keith Garrett, Ashland High School, Ashland, OR 97520.
Four-week workshop in computer science teaching.	Mike Clock, Pacific University, Forest Grove, OR 97116.
In-service training for computer science teachers; development of high school program in computer science.	William Taylor, Umatilla ESD, Pendleton, OR 97801.
Summer workshop on computer literacy and computing science for teachers.	Howard Bailey, Eastern Ore. State College, LaGrande, OR 97850.
Experimental project on computing instruction in elementary school.	Mike Neill, Lane ESD, Eugene, OR 97401.
Experimental project using computers as tools in math and science classes.	Mary Kurtz, West Sylvan School, Portland, OR 97225.

Date	Project	Participants
1974-75	Clackamas County Computing Specialist	
1974-75	Lakeridge High School Computing Project	
1974-77	Linn-Benton Community College Computer Science Program	15 Albany area high school teachers.
Summer 1974	Coos Bay Computer Science Workshop	20 Coos Bay area teachers.
1974-75	Computing Course for Elementary Teachers	
1974-75	Churchill High School Building Specialist	
1972-74	Yamhill County In-Service Project	37 Yamhill County teachers.
1975-76	Rogue Community College Computer Education Project	
1975-77	Salem Computer Education Project	12-16 teachers per class.
1975-76	EOSC Computer Course	25 pre-service and in-service teachers.

Project Description	Project Director
Assist Clackamas ESD to establish position of computer science specialist.	Marshall Watkins, Clackamas ESD, Marylhurst OR 97036.
Experimental program testing use of mini-computer for instructional purposes.	Charles Geldaker, Lakeridge High School, Lake Oswego, OR 97034.
Summer workshop on teaching computer science with academic year implementation program.	James Moran, Linn-Benton Community College, Albany, OR 97321.
Two-week summer workshop on computing science for teachers.	Alan Hendrickson, Marshfield High School, Coos Bay, OR 97420.
Development and testing of course in computing for pre-service elementary teachers.	James McFarland, Southern Oregon State College, Ashland, OR 97520.
Experimental program providing building specialist for interdisciplinary use of computers in classrooms.	John Shirey, Winston Churchill High School, Eugene, OR 97401.
In-service courses on computing for teachers.	Glen Stonebrink, Linfield College, McMinnville, OR 97128.
Assist Rogue Community College develop instructional computing	Dick Holliday, Rogue Community College, Grants Pass, OR 97526.
Series of three in-service classes for Salem area teachers, assist in purchase of equipment for instructional use.	Robert Jaquiss, North Salem High School, Salem, OR 97301.
A computer literacy course for secondary teachers.	Howard Bailey, EOSC, LaGrande, OR 97850.

Date	Project	Participants
1975-76	Teacher Awareness Project	Approximately 125 secondary teachers from around state.
1975-76	Cooperative Science Museum Project	
1975-76	Redmond High School Computer Education	
1975-76	Computer Enthusiast Project	
1975-76	Eugene Computer Science In-Service	20 Eugene-Springfield area teachers.
1975-76	Lebanon Computer Project	12 teachers from various grade levels.
1975-76	Edgewood-Willard Elementary Calculator Project	
1975-76	Douglas ESD Special Education Project	13 secondary teachers of EMR students.
1975-76	Salem Junior High School Computer Project	

Project Description	Project Director
Conduct computer simulation workshops for teachers of math, science, and business.	
Assist in the development of the science education program of the Lane County Cooperative Science Museum.	Dick Ricketts, Univ. of Oregon, Eugene, OR 97403.
Assist in the development of Computer education program at Redmond High School.	Marcia Logan, Redmond High School, Redmond, OR 97756.
Cooperative project with the Oregon Council for Computer Education to identify and encourage computer enthusiasts.	David Moursund, Univ. of Oregon, Eugene, OR 97403.
In-service course for secondary teachers who have had no previous experience in using the computer as a resource.	David Moursund, Univ. of Oregon, Eugene, OR 97403.
In-service course on the computer as an instructional aid.	Loran Sell, Lebanon Union High School, Lebanon, OR 97355.
Develop and test materials for calculator usage in grades 4-6.	Karen Beisse, Edgewood Elementary School, and Ann Horn, Willard Elem. School, Eugene, OR 97405
Assisting teachers in the use of calculators in special education.	Bill Young, Douglas ESD, Roseburg, OR 97470.
Providing computer access at three Salem junior high schools.	Robert Jaquiss, North Salem High School, Salem, OR 97301.

Date	Project	Participants
1975-77	North Clackamas Microcomputer Project	
1975-76	Southern Oregon In-Service Computing Course	15 secondary teachers in the Medford area.
1976	Willamette University Microcomputer Project	
1976-77	Newport Calculator Project	
1977	Douglas County Computer Projects	25 elementary and secondary teachers from Douglas County.
1977	Riddle Microcomputer Project	
1977	Eugene-Springfield Computer Club	
1977	Computers in Art	
1977	Curry County Computer Project	

Project Description	Project Director
Purchase of micro-computer kits for classroom use.	Gerald Larer, Milwaukie High School, Milwaukie, OR 97222.
An in-service course on instructional applications of the computer.	James McFarland, Southern Oregon State College, Ashland, OR 97520.
Assisting in the acquisition of microcomputer equipment for instructional use.	Mike Dunlap, Willamette University, Salem, OR 97301.
Incorporating the use of calculators into the Lincoln County high school math program	David Dempster, Newport High School, Newport, OR 97365.
In-service course on instructional computing, assist in obtaining computing equipment for instructional use.	Jim Presley, Douglas ESD, Roseburg, OR 97470.
Assist in purchase of microcomputer kit for instructional use.	Rodney Steen, Riddle High School, Riddle, OR 97469.
Assist in purchase of microprocessor for use of area students.	David Moursund, U. of O. Eugene, OR 97403.
Development of Computers-in-Art slide-tapes presentation.	Beverly Jones, 3015 University St., Eugene, OR 97405.
Disseminate information and provide information about use of calculators and computers in instructional programs.	Jean Rogers, Star Rt. Box 151-A, Port Orford, OR 97465.

Date	Project	Participants
1977	Umpqua Valley ICC	
1976-77	Catlin-Gabel Computer Education Project	
1975-76	Clackamas County Computer In-Service	

Project Description	Project Director
Assist Umpqua Valley Instructional Computing Consortium conduct summer workshop for area teachers.	Jim Presley, Douglas ESD, Roseburg, OR 97470.
To develop computer science education resource center, available to the public; strengthen computer science program at Catlin-Gabel school.	Ronald Tenison, Catlin-Gabel School, Portland, OR 97225.
Conduct in-service training for junior high teachers; facilitate introduction of computing into three junior high schools in North Clackamas School Dist.	Gerald Larer, Milwaukie High School, Milwaukie, OR 97222.

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COMPONENT FIVE: COMMUNICATIONS

The Oregon Council of Teachers of Mathematics (OCTM) was the System's main communication link with Oregon educators. OSME supported an OCTM administrative assistant and subsidized OCTM publications. OSME also supported the OMSI Communications Resource Center, which still maintains OCTM and OSME mailing lists, assists in the preparation of publications, and provides for their distribution. The Center also assists with the collection, classification and storage of data for the State Department of Education and other groups. Upon request, it provides information on mathematics resource services available in the State. In addition, OMSI maintains an elementary mathematics center where elementary school classes and individual students who visit OMSI may participate in mathematical activities.

Component Five

Date	Project	Project Director
1972-73	Oregon Council of Teachers of Mathematics	Michael Dalton, 2540 SW Custer, Portland, OR 97219.
1972-73	Oregon Museum of Science & Industry Communications Resource Center	Michelle Girts, OMSI, Portland, OR 97221.
1972-77	OSME Conference Program	Staff
1975-77	OSME Dissemination Activities	Staff
1975-77	Math Guide Development Project	Don Fineran, Oregon Dept. of Education, Salem, OR 97310.
1975-77	Oregon Museum of Science & Industry Mathematics Laboratory	Lois Gibbons, OMSI, Portland, Or 97221.
1977	Math Learning Center Dissemination Project	Barry Mitzman, Linfield College, McMinnville, OR 97128.
1977	Teacher Certification	Glenn Harrison, 1132 W. 30th Place, Albany, OR

Project Description

Provide for office of administrative assistant, subsidize conference and publications program to serve as system communications link with teachers.

Maintain computerized data bank on Oregon science and math teaching; provide mailing services; operate math learning lab for use of school children visiting OMSI.

Conduct conferences on current issues of math education.

Prepare and disseminate written materials describing OSME activities and assessing their impact; assisting persons in out-of-state areas establish OSME-type workshops; establish math learning center.

Assist state mathematics specialist in revising the Oregon Department of Education Mathematics Curriculum Guide.

Establish mathematics laboratory for school children and museum visitors.

Dissemination information on OSME through newsletters, mailings.

Distribute questionnaire and prepare report on Oregon educators' views of teacher certification standards in mathematics.

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